



GOALS FOR COMBINED ENDEAVOR 2004

To contribute Combined Endeavor by sharing the experience gained by the Turkish System.

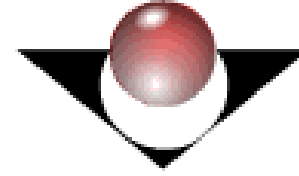


Demonstrate Interference Analysis using a new approach.

Collaborate on International level



UNCLASSIFIED



TÜBİTAK UEKAE

**TURKISH GENERAL STAFF
COMMUNICATION AND INFORMATION
SYSTEMS**

**NATIONAL RESEARCH INSTITUTE OF
ELECTRONICS AND CRYPTOLOGY**

MANAGEMENT AND ANALYSIS OF RADIO SPECTRUM

COMBINED ENDEAVOR 2004

Lager Aulenbach

MAY 11, 2004

UNCLASSIFIED

CONTENTS



1. An Overview of  **Assoc. Prof.**
Gökhun TANYER

BS.MS.

Ph.D.EE

**Group Leader, ILTAREN Research Group,
TÜBİTAK-UEKAE (NRIEC)**

2. Demonstration

DBMS - DataBase Management System

D. İlhan

TÜFEKÇİ

BS.MS.EE

**DBMS Team Leader, ILTAREN Research Group,
TÜBİTAK-UEKAE (NRIEC)**



PROGRAM



COMBINED ENDEAVOR 2004

	TUESDAY	WEDNESDAY
10:30 - 11:15	Overview - Presentation	
11:15 - 11:30	DBMS - Demonstration	
11:30 - 12:00	SMAS - Demonstration	
13:30 - 14:45		Overview - Presentation
14:45 - 15:00		DBMS - Demonstration
15:00 - 15:30		SMAS - Demonstration



PROGRAM



	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
10:30 - 11:15	Overview - Presentation	Support to Nations -System perf. anal. -Spectrum man.	Support to Nations -System perf. anal. -Spectrum man.	Support to Nations -System perf. anal. -Spectrum man.
11:15 - 11:30	DBMS - Demonstration			
11:30 - 12:00	SMAS - Demonstration			
13:00 - 14:30		Overview - Presentation	Support to Nations -System perf. anal. -Spectrum man.	
14:30 - 16:00		DBMS - Demonstration		
16:00 - 17:00		SMAS - Demonstration		



An Overview of

MANAGEMENT AND ANALYSIS OF RADIO SPECTRUM

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MANAGEMENT AND ANALYSIS OF RADIO SPECTRUM

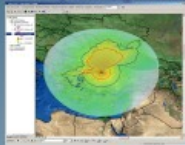


TÜBİTAK UEKAE
İLTAREN Research Group

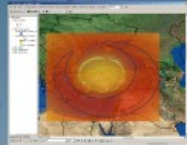
Coverage Analysis

Communication Systems

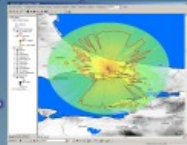
Coverage field can simply be defined as the service area corresponding to a transmitter system. It is also defined as the region where a receiver is guaranteed to receive the minimum signal level required for sufficient quality of communication (for radar systems: the sufficient signal level received at the radar receiver due to a given target). For coverage area calculations, MARS users can utilize various propagation models, including the ITU's Recommendations and various empirical methods for RMD (Reflection and Multiple Diffraction) calculations. The received power level (or the transmitted power level) at the receiver location can be displayed on the map via GIS (Geographical Information System) using user-friendly color coding format. Multiple coverage contours corresponding to different receiver sensitivities can be displayed simultaneously.



Search Area Analysis
Line of Sight
Antenna Patterns
Database Query Interface



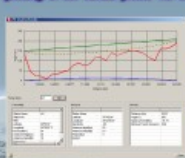
Search Area Analysis
Line of Sight
Antenna Patterns
Database Query Interface



Search Area Analysis
Line of Sight
Antenna Patterns
Database Query Interface

Link Systems

Performance evaluation of the terrestrial microwave link systems by calculation of Line of Sight (LOS) and Fresnel region(s) and the signal level at the receiver and plotting of the terrain profile via GIS (Geographical Information System).



Search Area Analysis
Line of Sight
Antenna Patterns
Database Query Interface

Radar Systems

The signal intensity received at the radar receiver due to a given target is calculated. The target parameters (RCS, altitude, etc.) are used. The results are plotted on the map via GIS (Geographical Information System) using user-friendly color coding format. Multiple coverage contours corresponding to different receiver sensitivities and/or different targets can be displayed simultaneously.



Search Area Analysis
Line of Sight
Antenna Patterns
Database Query Interface



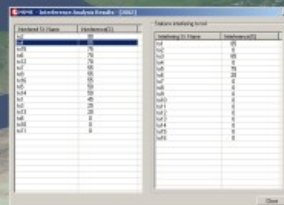
Search Area Analysis
Line of Sight
Antenna Patterns
Database Query Interface

Interference Analysis

Interference is observed when the quality of operation for an interfered station deteriorates below a minimum level due to receiving an unintentional signal emitted by an interfering transmitter(s). In the interference analysis, the interfered and the interfering stations are detected, the interfering/interfered area percentages are calculated and the results are formatted into an interference (relationship) table, automatically. The interference tables are calculated using the system parameters, geographical parameters, atmospheric effects and the frequency band. The results can be saved into a file for future reference. In the interference analysis, the list of possible interfering stations are detected, coverage areas for each station are calculated, interference tables are constructed and the results are used into calculating the list of frequency channels acceptable for assignment for the new station, all automatically. Interference analysis can be executed for a list of stations which is constructed automatically by database query and/or by the user manually.

Systems

- Communication Systems
- LF/MF
- HF
- V/UHF
- Radar Systems
- Link Systems



INTERFERENCE ANALYSIS RESULTS TABLE

- Co-Channel / Adjacent Channel Effects
- Operating Hours
- Assignment Categories
- Interfering / Interfered Area Percentages
- Interfering / Interfered System Lists
- Transmitter / Receiver Antenna Patterns
- Database Query Interface

Other Calculations

Engineering Tools

Contour Plots

The results of the calculations are displayed as contour plots on the map. The user can select the color coding format for the contour plots.

Line of Sight



The results of the calculations are displayed as line of sight paths on the map. The user can select the color coding format for the line of sight paths.

Coordinate Converter

The user can convert the coordinates of the stations from one format to another.

HF LSP / MUF / FOT

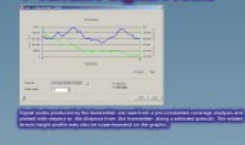


The results of the calculations are displayed as a table. The user can select the color coding format for the table.

Radiation Safety Distances

The user can calculate the radiation safety distances for the stations.

Terrain / Signal Profile



The results of the calculations are displayed as a graph. The user can select the color coding format for the graph.

Unit Converter

The user can convert the units of the parameters.

Azimuth / Distance

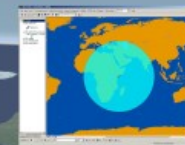
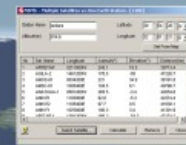


The results of the calculations are displayed as a graph. The user can select the color coding format for the graph.

Satellite Analyses

Look Angle

The elevation and azimuth angles, and distance between the geo-stationary satellites and ground stations are calculated.

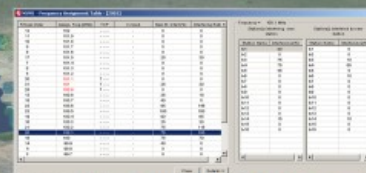


Footprint Analysis

The area on the world that can be seen by a satellite is calculated and plotted on map.

Frequency Assignment Analysis

In the frequency assignment analysis, the list of frequency channels acceptable for assignment are determined for a new (proposed) station. The software searches for the frequency channels where no interference is expected. The new station operating at those frequency channels is expected to be neither the interfering nor the interfered station. In the frequency assignment analysis, the list of possible interfering stations are detected, coverage areas for each station are calculated, interference tables are constructed and the results are used into calculating the list of frequency channels acceptable for assignment for the new station, all automatically.



FREQUENCY ASSIGNMENT RESULTS TABLE

- Co-Channel / Adjacent Channel Effects
- Joint Restricted Frequency List Data (Taboo / Protected / Guarded Frequencies)
- Operating Hours
- Assignment Categories (Peacetime / Field Trials / Wartime, etc.)
- Interfering / Interfered Area Percentages
- Interfering / Interfered System Lists
- Frequency Nomination
- Transmitter / Receiver Antenna Patterns
- Database Query Interface

Systems

- Communication Systems
- LF/MF
- HF
- V/UHF
- Radar Systems
- Link Systems



TÜBİTAK UEKAE - National Research Institute of Electronics and Cryptology

CONTENTS



1. TÜBİTAK UEKAE
2. History
3. Concept of Operations
4. System Architecture
5. System Requirements
 - ✓ Server and Client Requirements
6.  **SYSTEM version 2.2**
 - ✓ **DBMS - DataBase Management System**
 - ✓ **SMAS - Spectrum Management Analysis Software**
7. Web Interface, Reports, Training Program
8.  **v3.0**
DBMS v3.0, SMAS v3.0,



1995 National Research Institute of Electronics and Cryptology affiliated to Marmara Research Centre of TUBITAK* has been established.

1998 National Research Institute of Electronics and Cryptology has been affiliated directly to TUBITAK*.

(*) TUBITAK is the Research Institution of the Turkish Government.

Basic Groups for Research and Development

Center of Cryptanalysis

Algorithm Design and Certification



TEMPEST Test Centre

TEMPEST Test and Evaluations
EMC Test and Evaluations



Semiconductor Technologies Research Laboratories

Hardware Applications of Cryptography

Product Development

Design, Development and Production
of various INFOSEC products



İLTAREN /ARC - Ankara Research Center





HISTORY

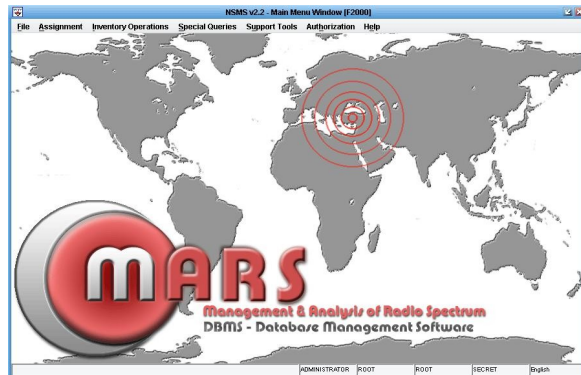


Jan. 1995	Concept of operations definition by TGS CIS Department
March 2000	Theoretical studies begins (NRIEC).
Dec. 2001	Analysis of National, International and NATO systems begins.
Feb. 2002	NRIEC signs contract with TGS GISD
Feb. 2002	Project Body begins; System Requirement Specifications General and Detailed Design Descriptions.
June 2002	Completion of DBMS v1.0 and SMAS v1.0 (prototypes) Turkish v.
Sept. 2002	Implementation of DBMS and SMAS.
Dec. 2002	System tests for DBMS v2.0 (Turkish and English v.)
May 2003	System tests for SMAS v2.0 and training for 32 sites.
July 2003	NSMS v2.2, Setup and Maintenance stage.
July 2004	MARS-SMAS v3.0, to be available.
Aug. 2004	MARS-DBMS v3.0, to be available.

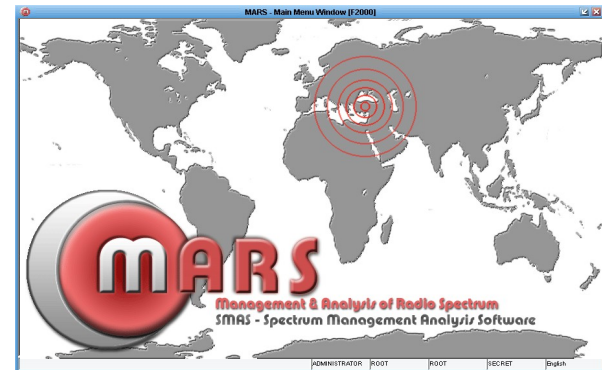
HISTORY



TURKISH GENERAL STAFF Communications and Information Systems Department



MARS - DBMS
DATABASE MANAGEMENT SYSTEM



MARS - SMAS
**SPECTRUM MANAGEMENT ANALYSIS
SOFTWARE**

Under TGS Command;

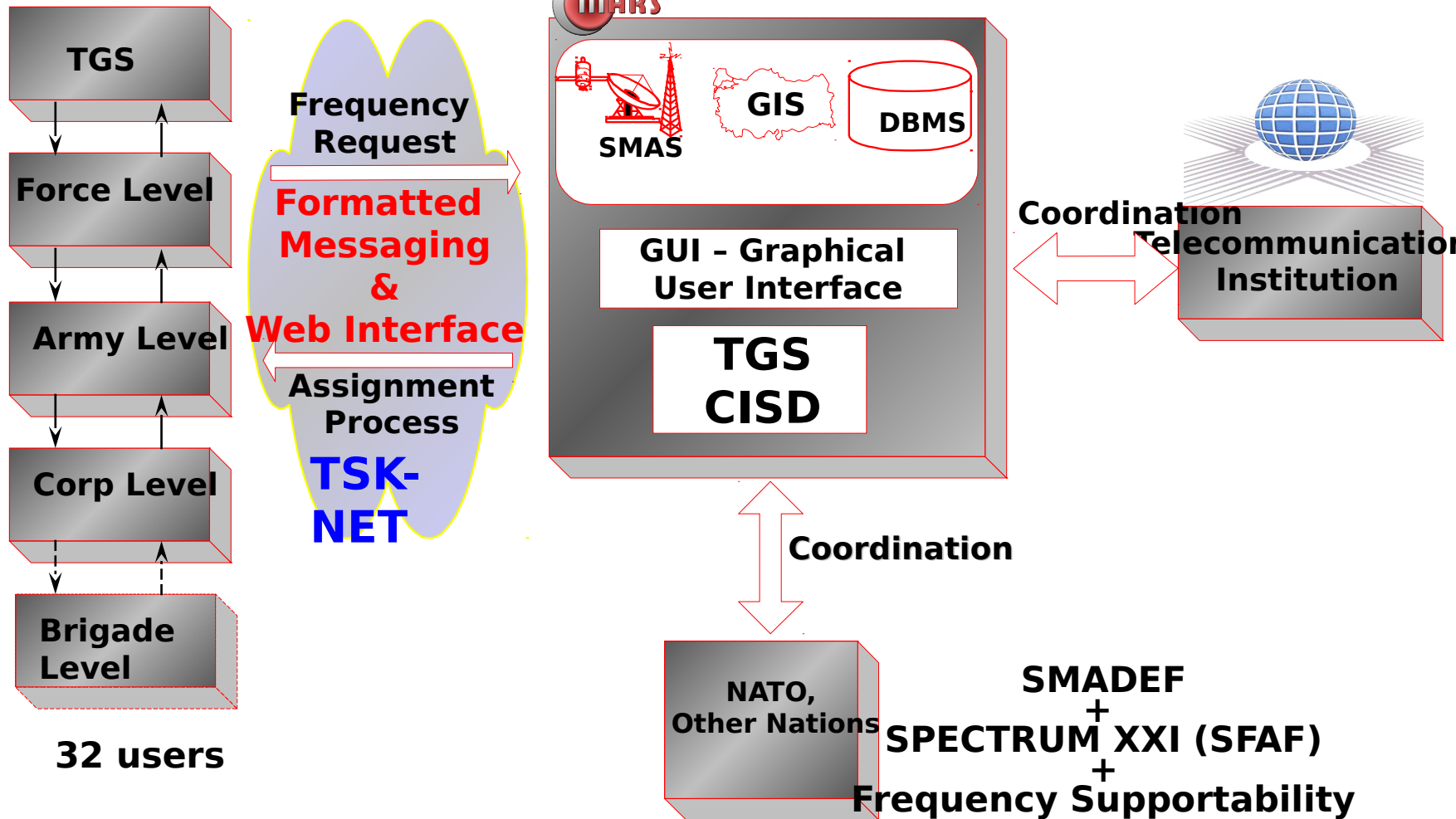
**Strategical,
Operative,
Tactical levels**

Joint

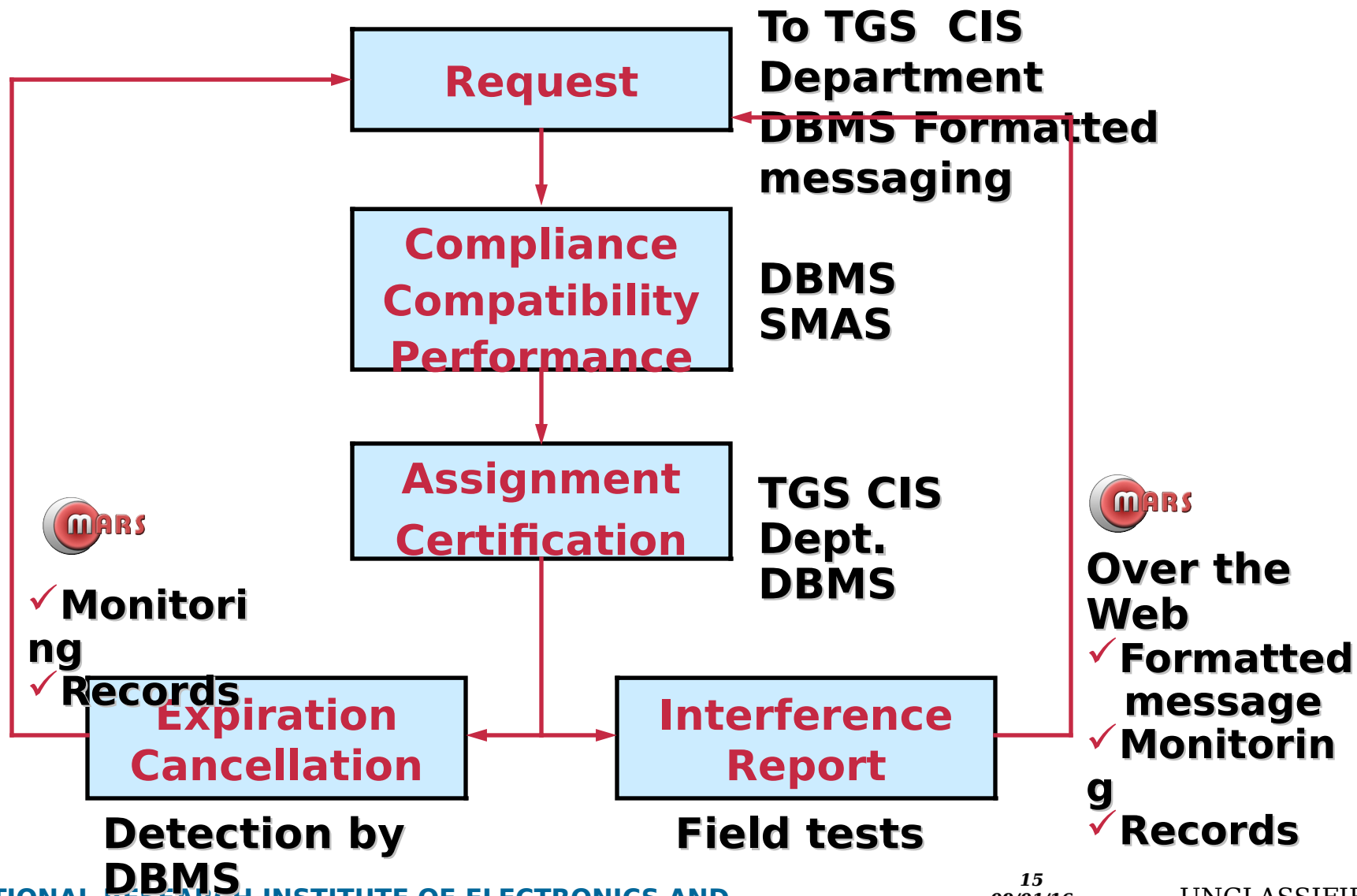
MANAGEMENT AND ANALYSIS OF RADIO SPECTRUM

ONE TEAM ONE GOAL !...

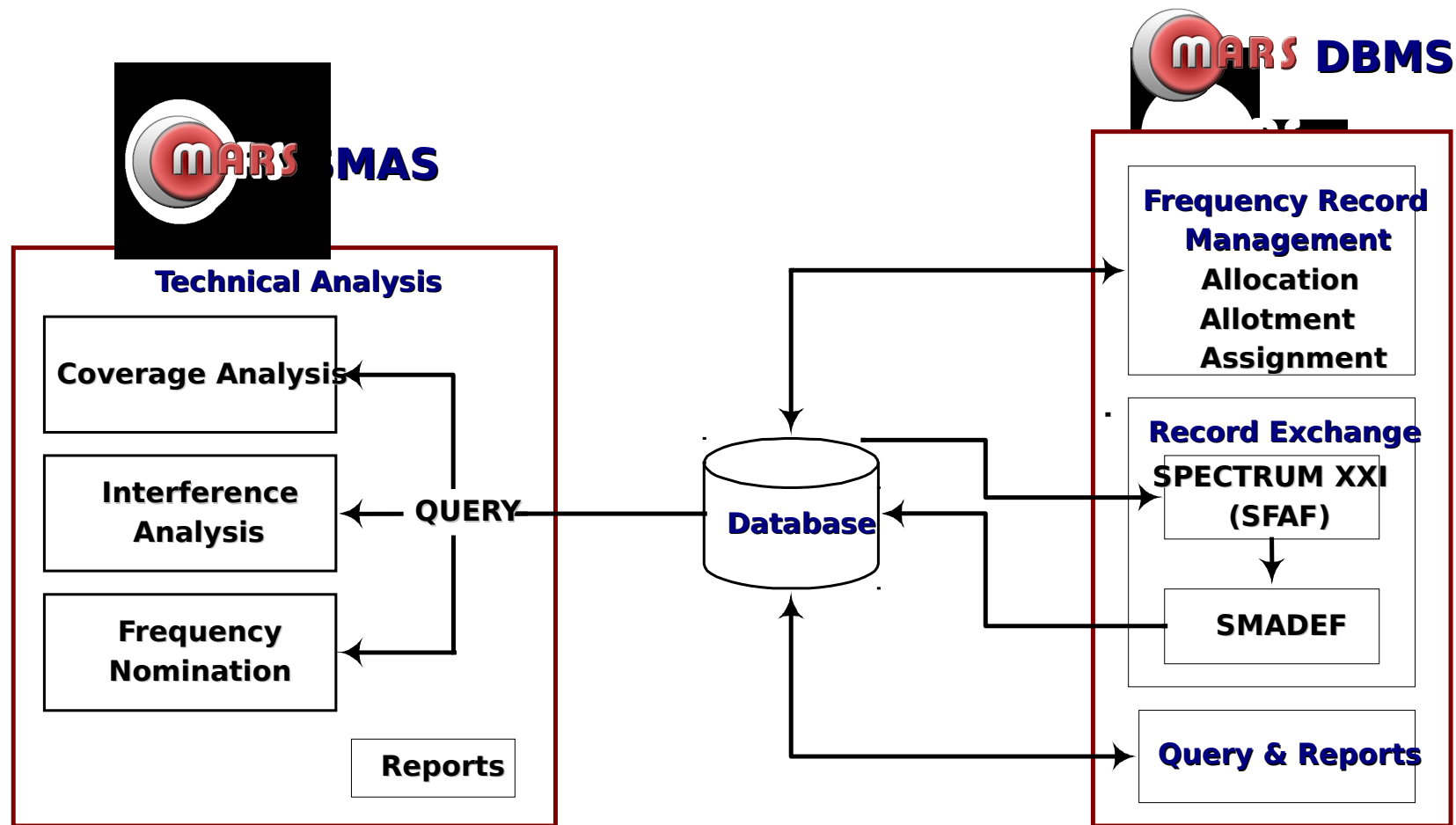
CONCEPT OF OPERATIONS



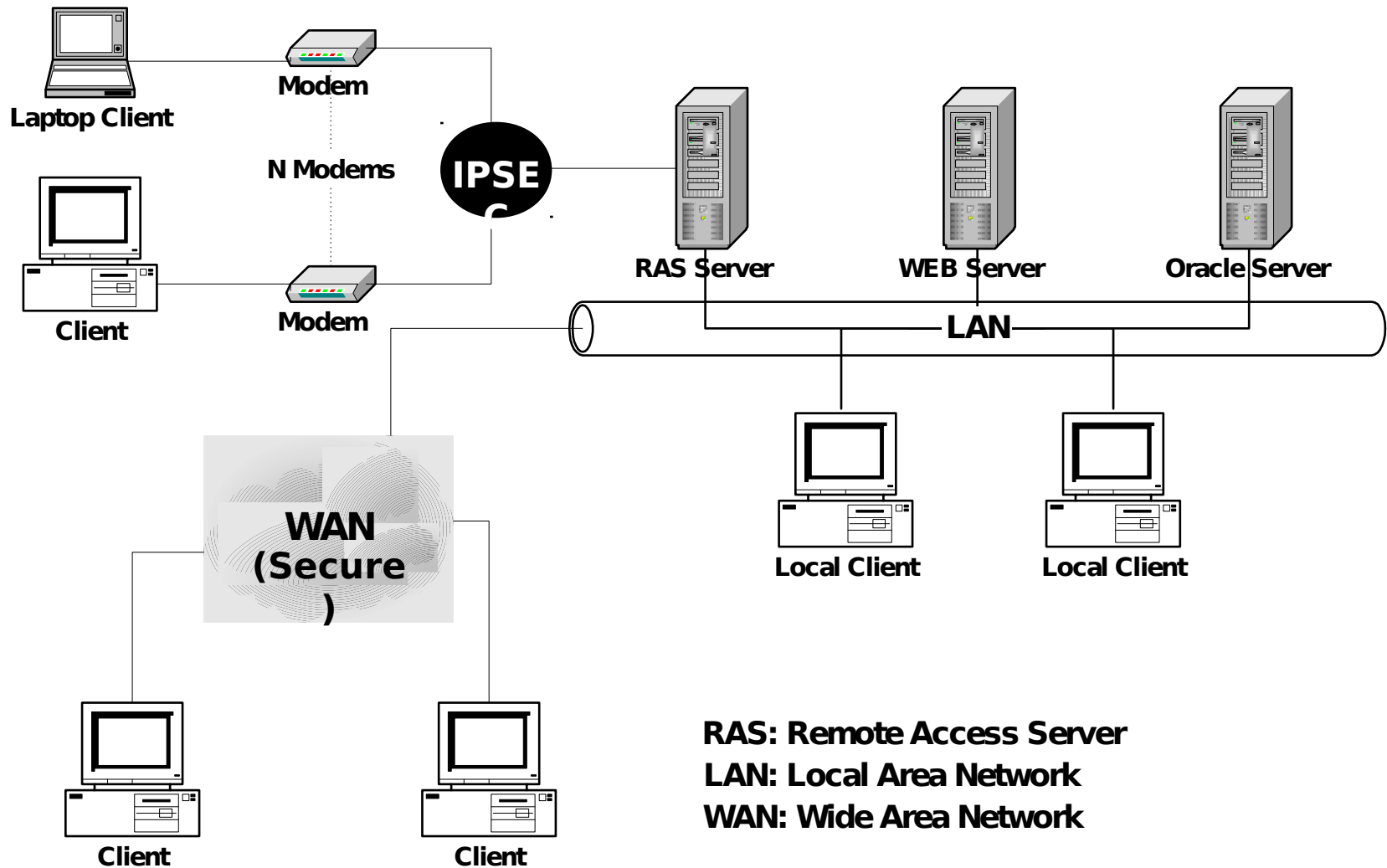
CONCEPT OF OPERATIONS



CONCEPT OF OPERATIONS



SYSTEM ARCHITECTURE



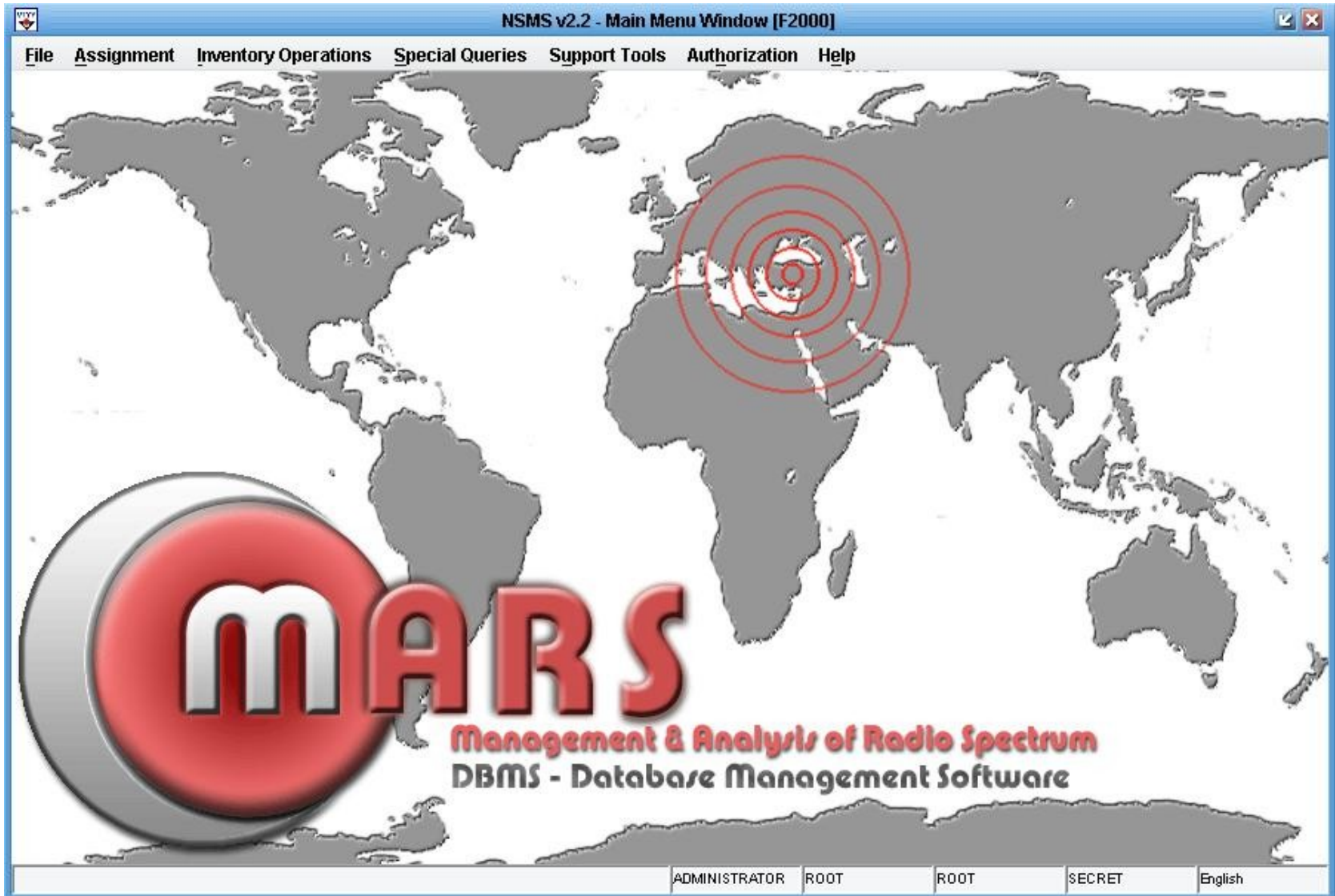


General

- ✓ On-line, off-line (standalone) operation
- ✓ Input from database, external file and/or user (keyboard)
- ✓ User authorization profiles for data access control and security
- ✓ On-line help
- ✓ Turkish/English versions are available (other languages ready)
- ✓ Documentation
 - ☐ Set up Guide
 - ☐ Administrator Guide
 - ☐ MARS User Guides (both for DBMS and SMAS)
 - ☐ Guides for Training Courses
 - ☐ Hard and soft copies are provided.



DATABASE MANAGEMENT SYSTEM



DBMS Capabilities

- ✓ Frequency record management
 - ☐ Frequency assignment and certification
 - ☐ Certification renewal
- ✓ Inventory Management
 - ☐ Equipment
 - ☐ Station
 - ☐ Antenna
- ✓ Interference report analysis
- ✓ Spectrum occupancy analysis
- ✓ Customized security definition based on form access
- ✓ Free query builder / Query reports
- ✓ Data exchange with
 - ☐ ARCADE (SMADEF)
 - ☐ Spectrum XXI (SFAF)
- ✓ GIS module

DATA BASE MANAGEMENT SYSTEM

Main Window

MARS - Assignment / NET Editor Window [F2077]

Assignment Information

Assign. No: **30,045** Requester: **AB00**  **NEW ASSIGNMENT**

Date Information

Assign. Date: **06/08/2003**

Start Date: **01/08/2003**

End Date: **01/09/2003**

Modification Date: **YENİ KAYI** 

Cancel Date:

Status Information

Status: **ACTIVE**

Temp./Perm.: **TEMPORARY**

NATO / National:

Security Level: **UNCLASSIFIED**

Remarks:

Operations

Extend

SAVE

CANCEL

DELETE

REPORT

CLOSE

Frequency Information

Insert **Delete** **Unused Freq.** **Paste Freq.** **Certificate**

	MTN	Frequency ...	Frequency ...	Actual/Spare	Working Tim
1	30,066	38.76		M ACTUAL	0024
2	30,067	38.77		M ACTUAL	0024
3	30,068	38.78		M ACTUAL	0024
4	30,069	38.79		M ACTUAL	0024
5	30,070	38.81		M ACTUAL	0024
6	30,071	38.82		M ACTUAL	0024
7	30,072	38.83		M ACTUAL	0024
8	30,073	38.84		M ACTUAL	0024
9	30,074	38.85		M ACTUAL	0024
10	30,075	38.86		M ACTUAL	0024

User Code: **AA00**  Carrier Freq.:

Usage Purpose: Circuit Type:

Usage Loc.: Circuit Category:

Description Note: **Yeni Frekans Tahsi** Circuit No:

Status Of JRFL: Service Code:

Station Information

İstasyon - 1027 

Station

New **Remove**

Station's

Type: **FX**

Work Code:

Latitude: **382051** **N**

Longitude: **0382017** **E**

Province: **MALATYA**

District:

TX Loc.:

User Code: **BB00**

Noise Level:

Surface Type:

Receiver Coordinates

Latitude: **370000** **N**

Longitude: **0352000** **E**

Receiver Loc.: **ADANA**

Description:

Equipment Information

☒ Radio ☐ HF/SSB ☐ Radar ☐ R/N ☐ R/L

Equipment Type: **RADIO**

Tuning Range: **30 - 75.975** **M**

Equipment's

Bandwidth: **3** **K**

Device Power: **25** **W**

Comm. Range: **8** **KM**

Tuning Inc.: **D**

Freq. Control: **M**

Other Equipment Parameters

Emission Type: **F** **3** **E**

Description:

Equipment

New **Remove**

Antenna Information

MANISA-RL-ANTENİ 

Antenna

New **Remove**

Antenna's

Code: **AP** Height: **40**

Pol.: **B** Gain: **40**

Max Broadcast. Dir.: **DIR**



DATABASE MANAGEMENT SYSTEM



Conflict Detection & Frequency Listings

MARS - R/L Conflict Detection Window [F2083]

Parameters of the proposed radiolink system
 TX-TX Sep. (MHz) TX-RX Sep. (MHz) RX-RX Sep. (MHz)

Parameters related to already existing radiolink system(s)

Equipment(s) on the First Tower

	TX	RX	TX-RX ...	TX-TX S...	RX-RX ...
1	7,200	28,000	28	28	154

Equipment(s) on the Second Tower

	TX	RX	TX-RX ...	TX-TX S...	RX-RX ...
1	28,000	7,200	28	28	154

Unused Frequency List

Min. Freq. (MHz)
 Max. Freq. (MHz)
 Increment

TX (Mhz)	RX (Mhz)
7375.0	7100.0
7375.0	7125.0
7375.0	7150.0
7375.0	7250.0
7375.0	7275.0
7375.0	7300.0
7375.0	7325.0
7400.0	7100.0
7400.0	7125.0
7400.0	7150.0
7400.0	7250.0
7400.0	7275.0
7400.0	7300.0
7400.0	7325.0

MARS - Unused Frequency List Window [F2081]

Frequency - M

☐ Area Query Active

Latitude N
 Longitude E
 Range km.

☒ List Joint Restricted Frequencies

	Frequency Min	Frequency Max	Bandwidth	City Name
13	31.3	M		A ANKARA
14	31.4	M		A ANKARA
15	31.5	M		A AMASYA
16	31.5	M		A ANKARA
17	31.525	M		A MALATYA
18	31.7	M		A ANKARA
19	31.8	M		A ANKARA
20	31.9	M		A ANKARA
21	32	M		A ANKARA
22	32.225	M		A MALATYA
23	32.3	M		A ELAZIĞ
24	32.4	M		A ANKARA

Clear Frequencies List

Bandwidth H
 Tuning Increment K

1543.	47.78
1544.	47.79
1545.	47.81
1546.	47.82
1547.	47.83
1548.	47.84
1549.	47.86
1550.	47.87
1551.	47.88
1552.	47.89
1553.	47.92
1554.	47.93

Assignment Frequency List

1.	30.08
2.	31.1
3.	44.94
4.	45.28
5.	47.91

Central Freq... MHz. Bandwidth MHz.

Selected frequency region: [47.9095 - 47.9105] MHz.

FMIN=30 MHz. FMAKS=50 MHz.

Current Frequency

Spectrum Occupancy



DATABASE MANAGEMENT SYSTEM



Assignment Query Window & Report

The screenshot displays the 'MARS - Assignment / NET Window [F2076]' interface. At the top, there are buttons for 'Query', 'Clear', 'Report...', 'Close', and a checked 'Show NFAP Information' option. To the right are buttons for 'New Assignment', 'New NET', and 'Export to Spectrum XML...'. Below these is the 'Query Criteria' section with various input fields: Frequency, Power, Assign. No, MTN, User Code, Province, District, Level, Working Time, Circuit Category, Equipment Type, Start Date, End Date, Station Type, and Record Type. A blue arrow points to the 'Equipment Type' field.

Below the query criteria is a table with columns: City Name, Circuit No, S..., Equipment Type, Emis..., Device P..., Temp./Perm., Assign. Date, Start Date, and End Date. The table contains several rows of data, mostly with 'TEMPORARY' in the Temp./Perm. column.

Overlaid on the table is a 'Report Options Window [F2082]'. It has a text input field, a date field set to '16/09/2003', a 'Security Level' dropdown set to 'UNCLASSIFIED', and 'Cancel' and 'Print' buttons.

At the bottom, there is a detailed view of a specific assignment. It shows 'Frequency Min' (1215), 'Frequency Max' (1240), and 'ITU / RR-Region 1' (EARTH EXPLORATION SATELLITE (active)). It also lists 'RADIOLOCATION', 'RADIONAVIGATION - SATELLITE (S/E) (S/S) S5.329 S5.329A', and 'SPACE RESEARCH (active) S5.331 S5.332'. To the right, under 'CEPT', it lists 'RADIOLOCATION', 'RADIONAVIGATION - SATELLITE (S/E) (S/S) S5.329 S5.329A', 'EARTH EXPLORATION SATELLITE (active)', 'SPACE RESEARCH (active)', and 'RADIONAVIGATION'.



DATA BASE MANAGEMENT SYSTEM



Assignment Window & Certification

MARS - Assignment / NET Editor Window [F2077]

Assignment Information

Assign. No: **30,048** Requester: **AA00** **NEW NET**

Date Information

Assign. Date: **06/08/2003**

Start Date: **06/08/2003**

End Date: **06/08/2008**

Modification Date: **06/08/2003**

Modification: **GUNCELLI**

Cancel Date:

Status Information

Status: **ACTIVE**

Temp./Perm.: **PERMANENT**

NATO / National:

Security Level: **UNCLASSIFIED**

Remarks:

Operations

Extend **SAVE** **CANCEL** **DELETE** **REPORT** **CLOSE**

Frequency Information

MTN	Frequency	Frequency	Actual/Spare	Working Time
1	30,080	31	M ACTUAL	0818
2	30,081	2.222	M ACTUAL	1808
3	30,082	27.777	M SPARE	0818
4	30,083	1.333	M SPARE	1808
5	30,084	2.888	M SPARE	1808

Station Information

Istasyon - 1029

Station's: **Istasyon - 1029**

Type: **FX**

Work Code:

User Code: **BB00**

Noise Level:

Surface Type:

Receiver Coordinates

Latitude:

Longitude:

Receiver Loc.:

Description:

Carrier Freq.

Usage Purpose

Usage Loc.

Description Note **Yeni Frekans Tahsi**

Status Of JRFL

Circuit Type

Circuit Category

Circuit No

Service Code

Antenna Information

MANISA-RL-ANTENI

Antenna(s) **New** **Remove**

Antenna's

Code: **AP** Height: **40**

Pol.: **B** Gain: **40**

Max Broadcast. Dir.: **DIR**

Other Equipment Parameters

Power Level

Alternate

☐ Scimitar Radio ☐ Cosite Filter

☐ SEMAC ☐ BID-1650

☐ COMSEC ☐ KW-46

Equipment(s)

MARCONI (100W)

AN/GRC-122

New **Remove**

Bandwidth **100 H**

Device Power **100 W**

Comm. Range **2,400 KM**

Tuning Inc. **P**

Freq. Control **S**

Emission Type **J 3 E**

Description

NET Information

Net Name **ILHANT-CEVRIM**

Net Description

Priority Level

User Group

Channel Type

Working Mode

NET Ctrl. St.

Broadcast

NET Comm.

Interference Priority Info **H** ☐ SEMAC

Coverage Priority Info **H** ☐ COMSEC

Alternate ☐ BID-1650

☐ KW-46

MARS - Certificate Options Window [F2084]

Certificate Options

Prepared By

Approved By

Certificate Date **16/09/2003**

Security Level: **UNCLASSIFIED**

Cancel **Print**



DATABASE MANAGEMENT SYSTEM



Military & Civil Organization Tree Structure

MARS - Assignment Users Tree Structure Window [F2004]

Operations Queries

Insert Save Delete Cancel Close

User Tree

- TSK
 - K.K.K.
 - DZKK**
 - Hv.K.K.
 - J.Gn.K.
 - SGK
 - CEPT
 - Telekomunikasyon Kurumu
 - ITU
 - ERC
 - NATO
 - Anıtkabir
 - Gülhane Askeri Tıp Akademisi

Selected User Information

No : 739 Superior 0 Order No: 2

Unit Name: DZKK

Level : KV.K.LİĞİ Circuit No : DZ 001-999

Force : DZ.K.K. User Code : DZKK

User Records

No	Unit Name
1,203	SG HAVA KOMUTANLIGI
1,202	TCSG-120 KOMUTANLIGI
1,201	TCSG-118 KOMUTANLIGI
1,200	TCSG-102 KOMUTANLIGI
1,199	TCSG-53 KOMUTANLIGI
1,198	TCSG-13 KOMUTANLIĞI
1,197	SG ISKENDERUN GRUP K.LIGI
1,196	TCSG-117 KOMUTANLIGI
1,195	TCSG-115 KOMUTANLIGI
1,194	TCSG-114 KOMUTANLIGI
1,193	TCSG-113 KOMUTANLIGI
1,192	TCSG-105 KOMUTANLIGI
1,191	TCSG-104 KOMUTANLIGI
1,190	TCSG-70 KOMUTANLIGI
1,189	TCSG-52 KOMUTANLIGI
1,188	TCSG-43 KOMUTANLIGI
1,187	TCSG-14 KOMUTANLIGI
1,186	TCSG-9 KOMUTANLIGI
1,185	SG ANTALYA GRUP K.LIGI
1,184	TCSG-116 KOMUTANLIGI
1,183	TCSG-108 KOMUTANLIGI



75 %



DATABASE MANAGEMENT SYSTEM

Reports

16/09/2003**UNCLAS SIFIED**

	Frekans Alt	Frekans Üst	Hiz Kodu	Kullanıcı Kodu	TX_Yeri	RX_Yeri	Band Gen.	Emis.	Güç	De.T	De.K	Devre NO
M	31	-		BB00			100 H	J3E	100 W			
M	31	-		BB00			3 K	J3E	400 W			
M	31	-		BB00		HAREKAT	100 H	J3E	100 W			
M	31	-		BB00		HAREKAT	3 K	J3E	400 W			
M	2.222	-		BB00			100 H	J3E	100 W			
M	2.222	-		BB00			3 K	J3E	400 W			
M	2.222	-		BB00		HAREKAT	100 H	J3E	100 W			
M	2.222	-		BB00		HAREKAT	3 K	J3E	400 W			
M	27.777	-		BB00			100 H	J3E	100 W			
M	27.777	-		BB00			3 K	J3E	400 W			
M	27.777	-		BB00		HAREKAT	100 H	J3E	100 W			
M	27.777	-		BB00		HAREKAT	3 K	J3E	400 W			
M	1.333	-		BB00			100 H	J3E	100 W			
M	1.333	-		BB00			3 K	J3E	400 W			
M	1.333	-		BB00		HAREKAT	100 H	J3E	100 W			

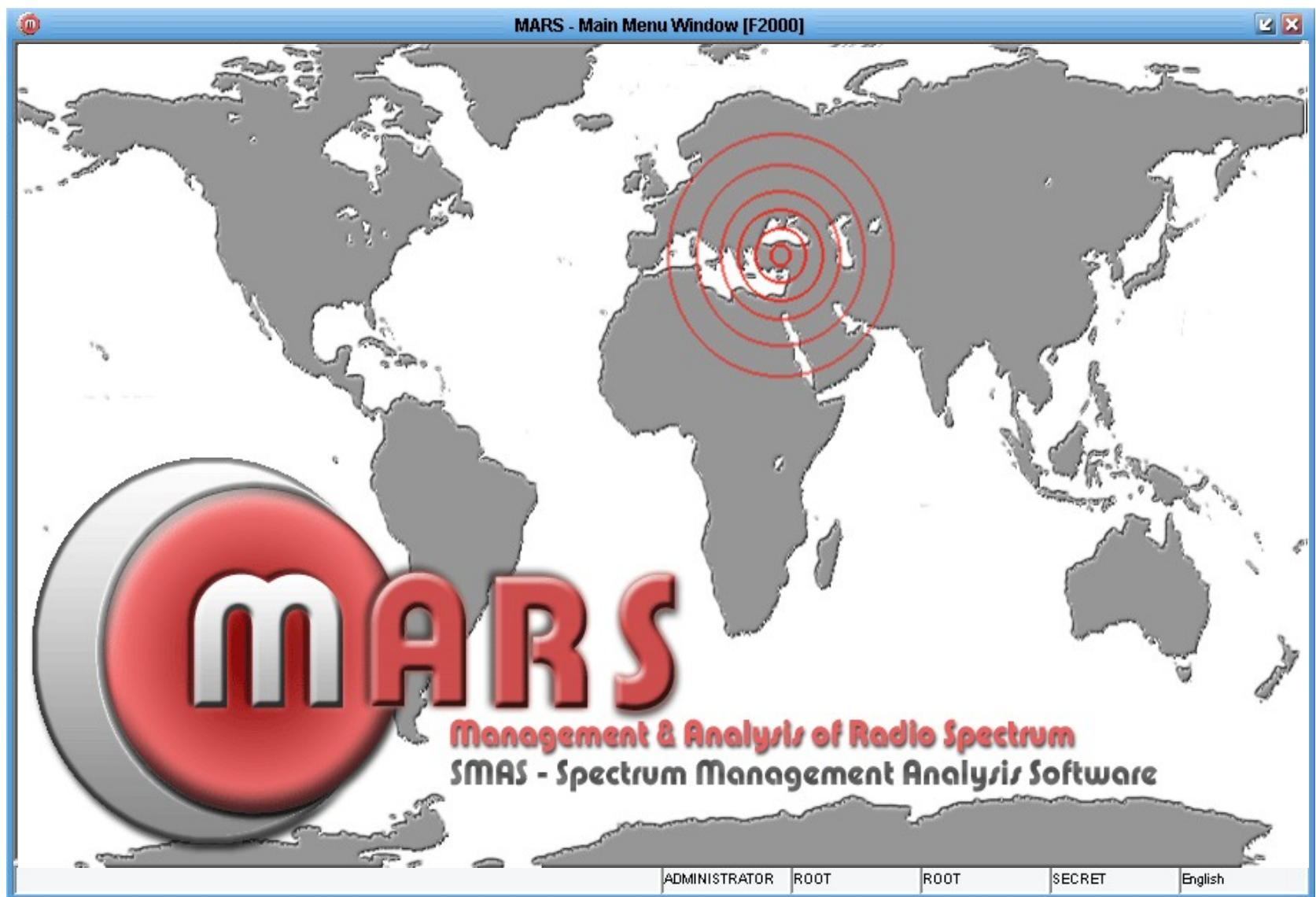
16/09/2003**UNCLAS SIFIED****Page 1**



SPECTRUM MANAGEMENT AND ANALYSIS



COMBINED ENDEAVOR 2004





SPECTRUM MANAGEMENT AND ANALYSIS



SMAS Capabilities - 1/2

✓ Propagation Models

ITU Rec.525 (Free Space), ITU Rec.368 (LF-MF), ITU Rec.533 (HF)

ITU Rec.370 (VHF-UHF), ITU Rec.529 (land mobile)

ITU Rec.452 (link), ITU Rec.526 (diffraction) UTD, Epstein, Deygout

✓ Coverage analysis

Contour plot

Received signal power level plot

Line of sight plot

✓ Radiolink analysis

Point to point link establishment, star and mesh networks

Cosite analysis support (DBMS)

Terrain profile and Fresnel zone plots

✓ Interference analysis

Determination of interfering and interfered transmitters

Interference levels [in%] (for VHF/UHF)

Dig. terr. elev. data is used in/for calculating the EM propagation/scattering effects.



SPECTRUM MANAGEMENT AND ANALYSIS



SMAS Capabilities - 2/2

✓ Automated frequency assignment analysis*

Determination of suitable frequencies.

(*) JRFL-Joint Restricted Frequency List, Operating Hours, Peace-War categories are used.

✓ HF link establishment

Point to point link establishment

Radio network establishment

✓ Radar systems

Early warning, surface/air search, Fire control, Target acquisition and tracking

✓ Satellite analysis

Look aspect angle calculation

Footprint analysis

✓ Engineering Tools

Contour calculation

Profile calculations

Coordinate converter

Radiation safety distance

Unit converter

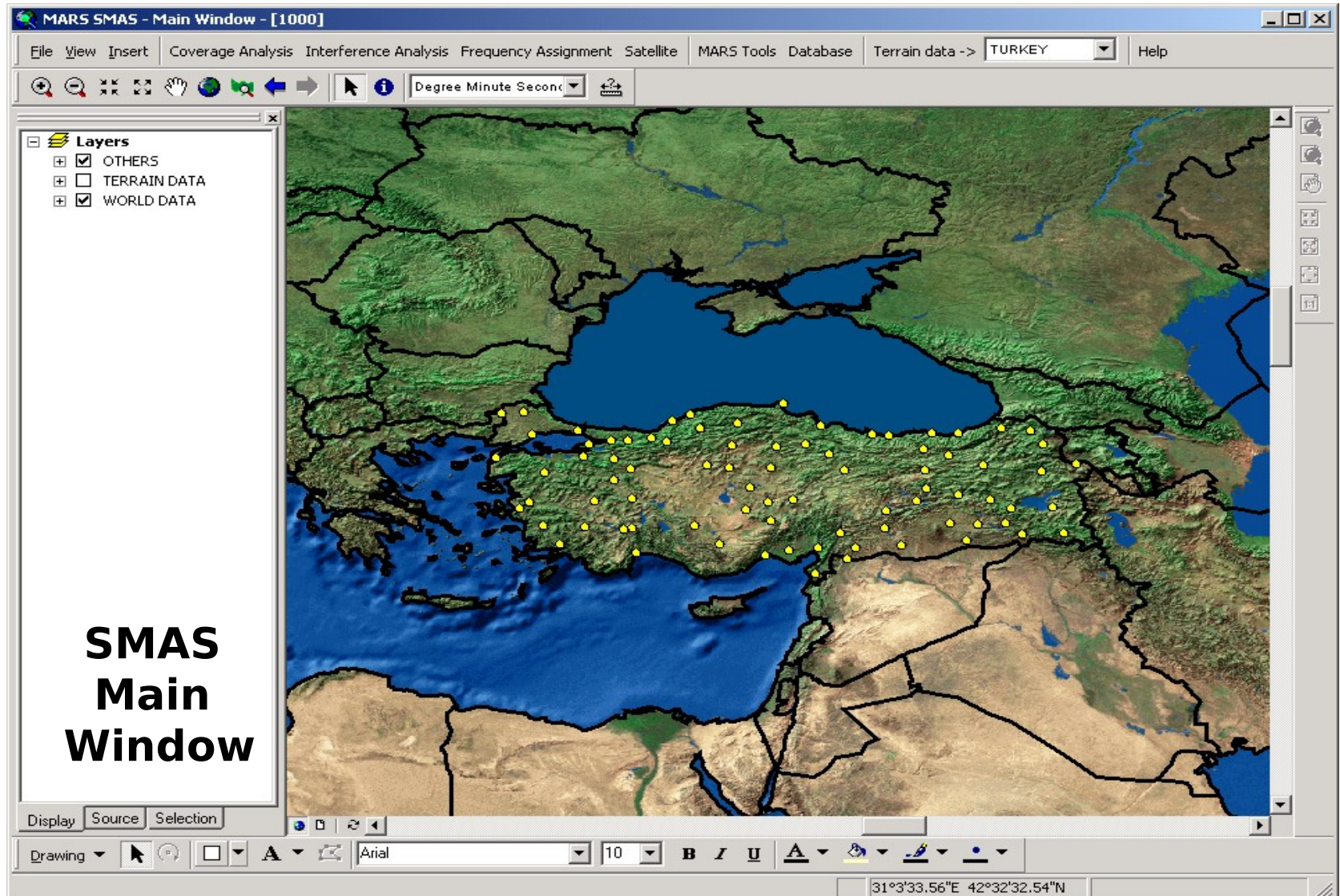
DTED merger

HF LUF/MUF/FOT analysis

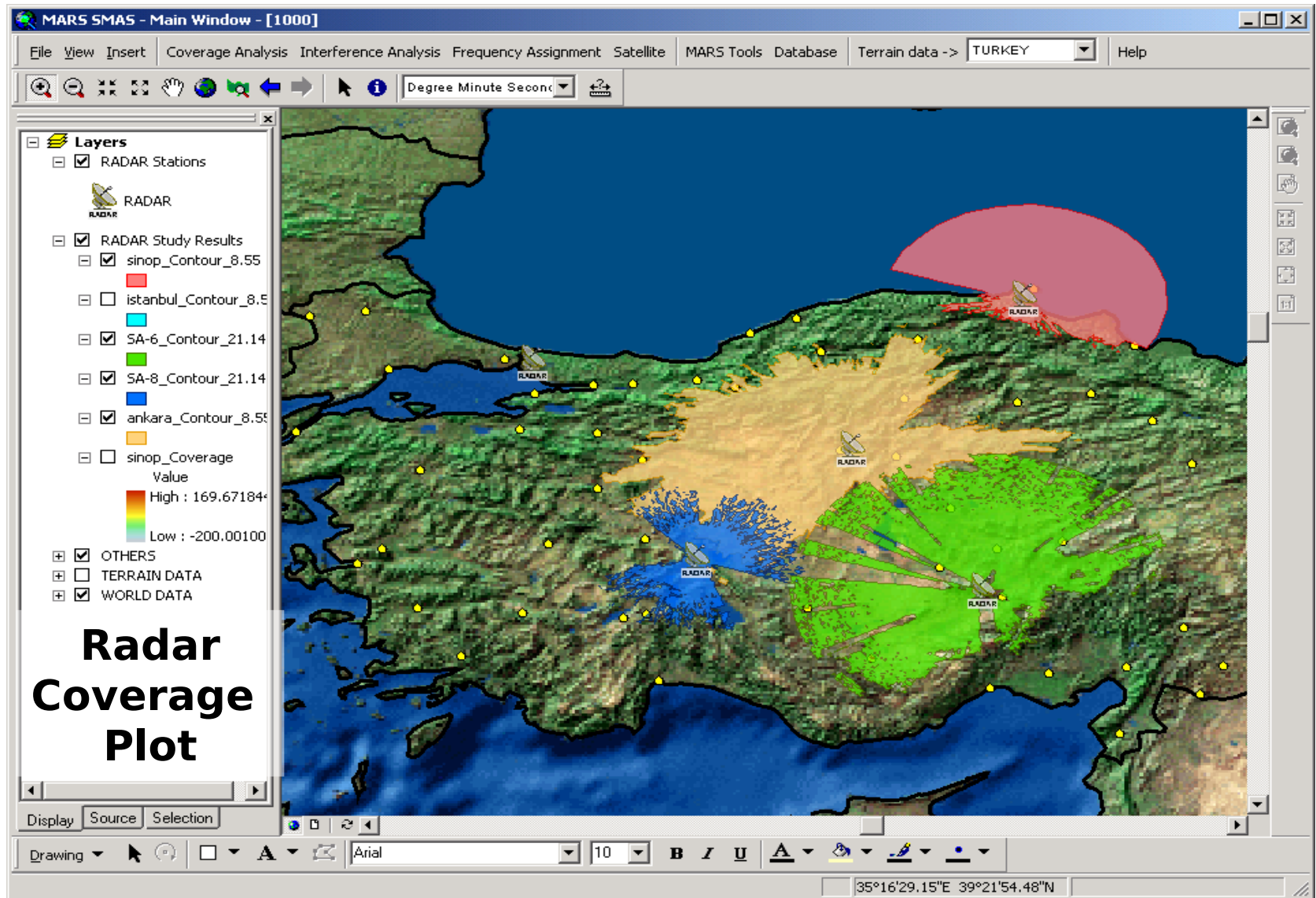
Frequency Bands for the system models:

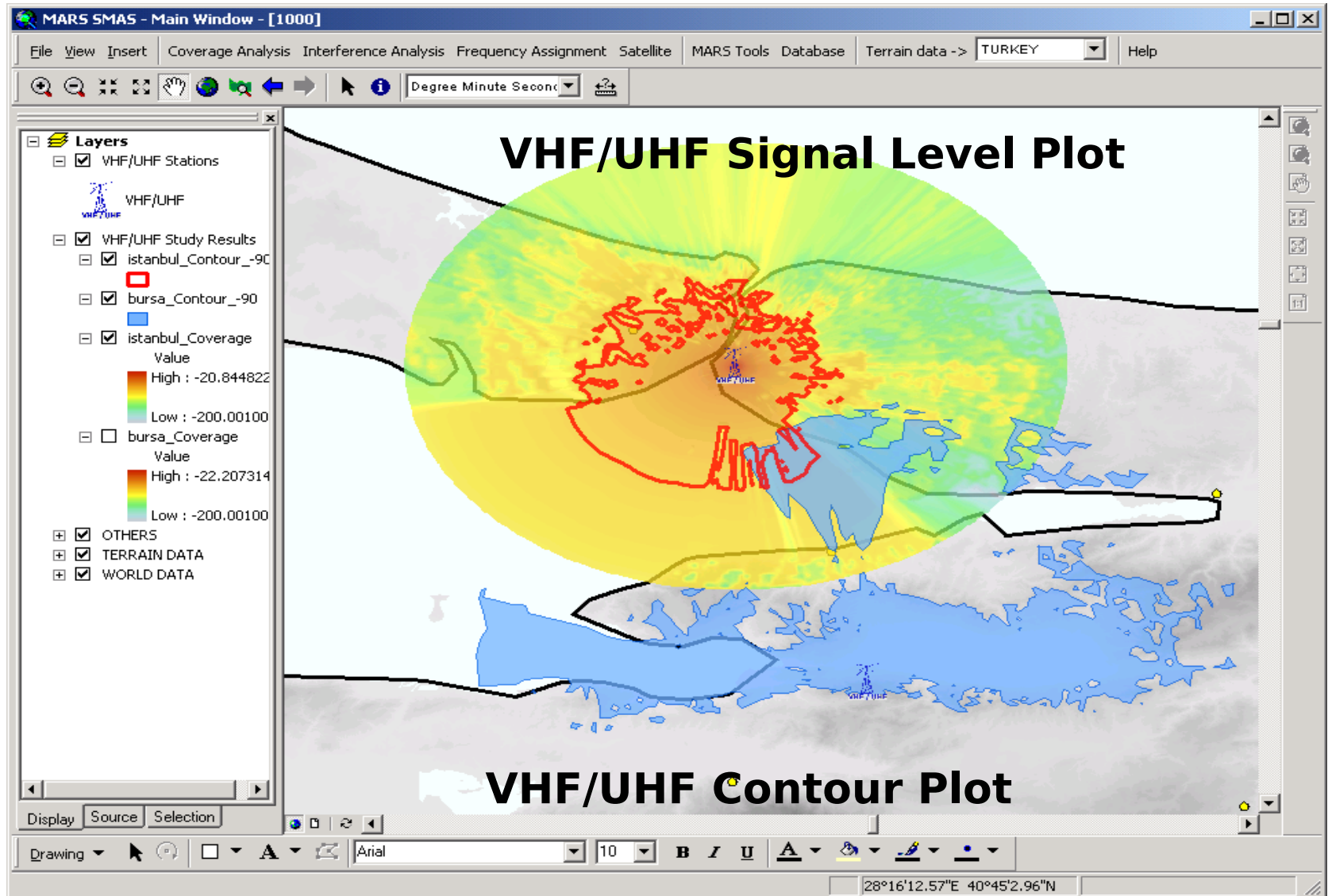
LF/MF	30 - 3000 KHz
HF	3 - 30 MHz
VHF/UHF	30 - 3000 MHz
RADIOLINK	0.7 - 40 GHz
RADAR	0.5 - 52 GHz

SPECTRUM MANAGEMENT AND ANALYSIS

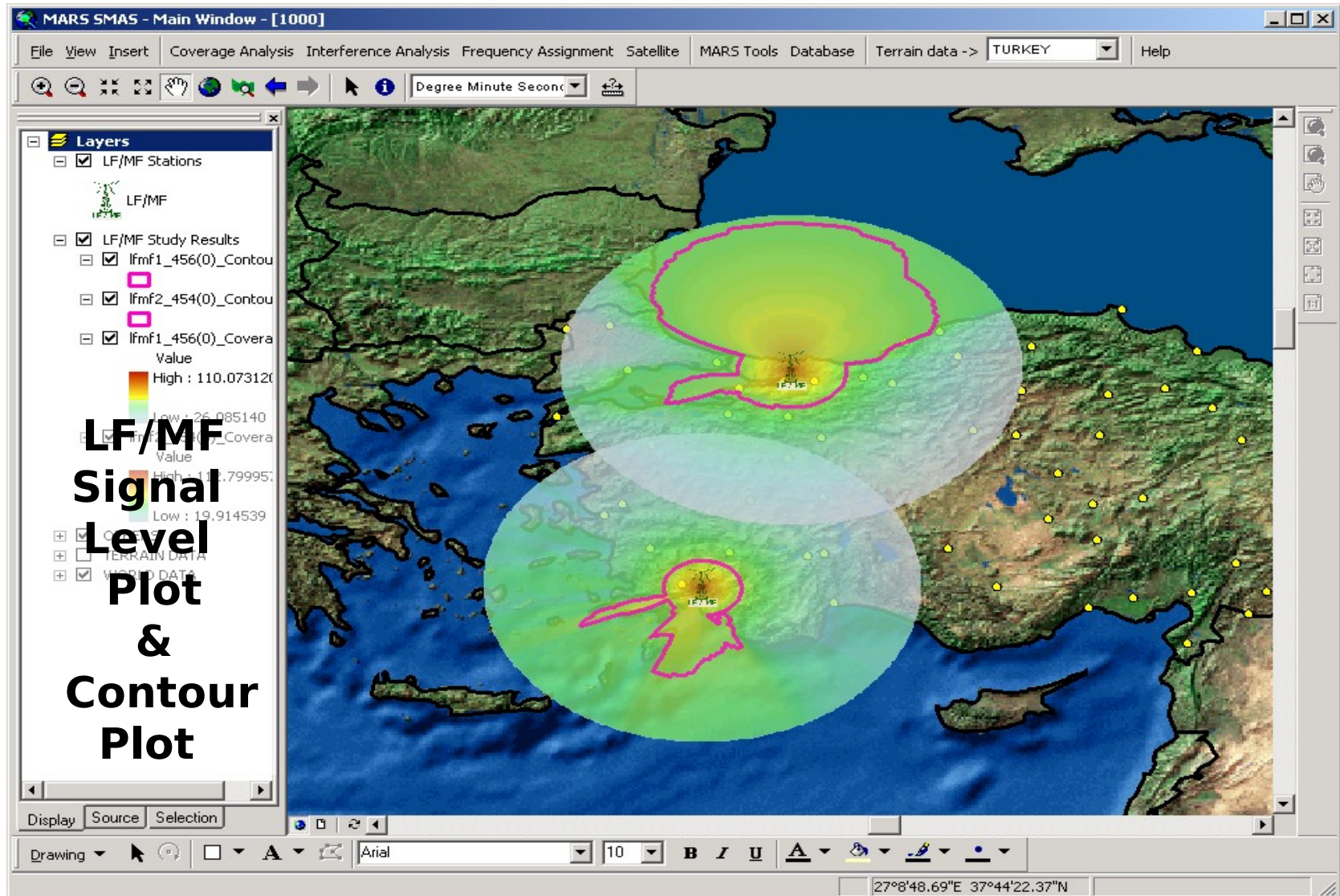


SPECTRUM MANAGEMENT AND ANALYSIS

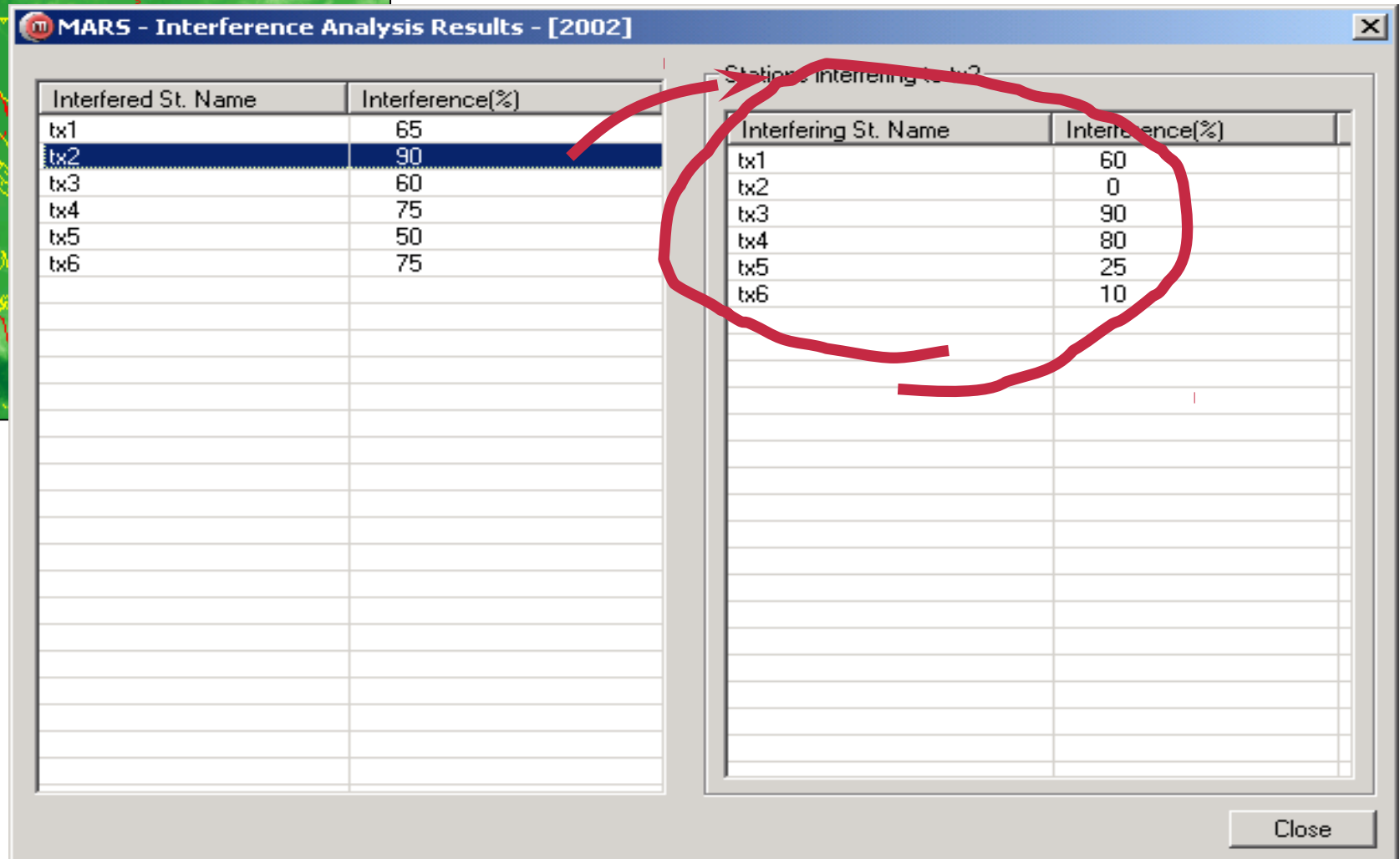




SPECTRUM MANAGEMENT AND ANALYSIS



Interference Analysis and Interference Lists



Frequency Assignments /Search For 'Suitable' Frequency Channels

MARS - Frequency Assignment Table - [2001]

Fitness Order	Assign. Freq.(MHz)	TGP	In Used	New St. Interf.(%)	Interfering Ratio
18	100.4			0	0
19	100.425			0	0
20	100.45			0	0
21	100.475			0	0
22	100.5			0	0
23	100.325			10	0
24	100.3			15	20
25	99.875			20	20
26	100.275			30	40
27	100.25			30	45
28	99.9			45	45
29	100.225			35	75
30	100.2			30	90
31	99.925			65	65
32	99.95			70	65
33	99.975			80	95
34	100.175			40	150
35	100			80	140
36	100.15			55	165
37	100.125			70	180
38	100.025			80	190
39	100.05			80	205
40	100.1			75	215
41	100.075			80	220

Frequency = 100 MHz

Station(s) interfering new station

Station Name	Interference(%)
tx1	80
tx2	0
tx3	40
tx4	40
tx5	10
tx6	0

Station(s) interfered by new station

Station Name	Interference(%)
tx1	65
tx2	0
tx3	0
tx4	55
tx5	20
tx6	0

Close Details <<

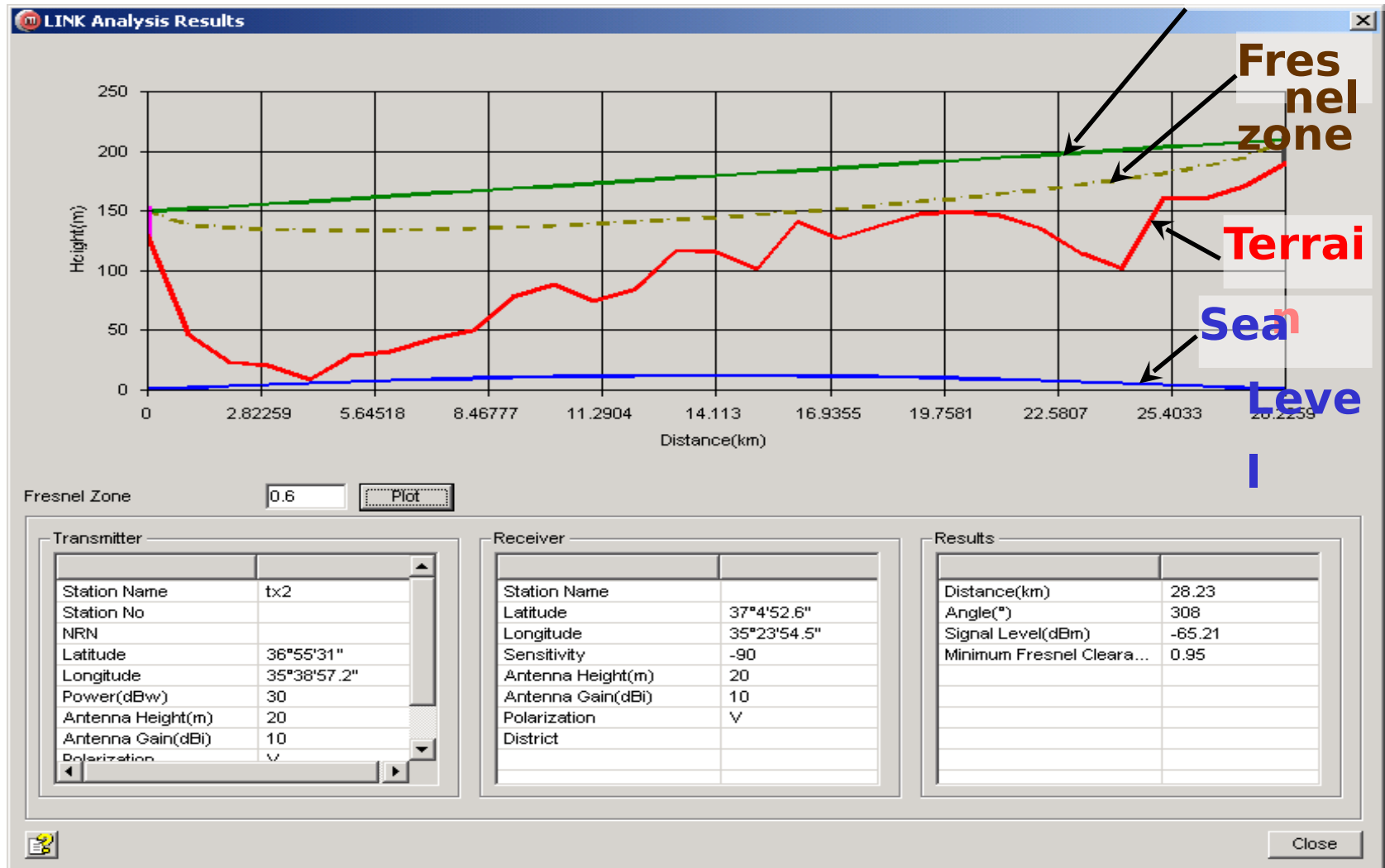


SPECTRUM MANAGEMENT AND ANALYSIS



Point to point link establishment

Line of sight





WEB INTERFACE



OPERATIONS OVER THE WEB

✓ **Correspondence /Document Tracking**

✓ **Access to;**

National /International (ITU, CEPT)

NATO Frequency Allocation Tables

✓ **Monitoring Frequency Assignments**

✓ **Frequency Assignment Request & Status Tracking**

✓ **Interference Resolution Request & Status Tracking**

MARS WEB INTERFACE

September 25, 2003-Thursday

Main Page

Please fill in your username and password.Username : Password : **Management & Analysis of Radio Spectrum System Web Interface**

These web pages are designed for authorized users of MARS.

- **FAP (Frequency Allotment Plan)**
Displays National/International (ITU, CEPT)/NATO Frequency Allotment Plan.
- **Correspondence Status**
Contains correspondence information and status related to frequency management.
- **Correspondence**
Contains a form used for inserting a new correspondence related to frequency management. Only Frequency Management Branch (FMB) users have authorization to access this page.
- **Correspondence Update**
Contains a form used for updating a correspondence record in the system. Only FMB users have authorization to access this page.
- **Assignment Tracking**
Displays hierarchical tree structure. Frequency assignment records owned by a unit in the hierarchical tree structure can be viewed through this page.
- **Frequency Request Message (FRM)**
Use this page to enter a new frequency request message into the system.
- **Frequency Request Message Status**
The status of the frequency request messages can be checked from this page.
- **Interference Message**
Use this page to enter a new interference message into the system.
- **Interference Message Status**
The status of the interference messages can be checked from this page.

MARS WEB INTERFACE

September 25, 2003-Thursday

[Main Page](#)[NFAP](#)[Correspondence
Status](#)[Owned Frequency
Assignments](#)[Frequency Request
Message \(FRM\)](#)[FRM Status](#)[Interference Message](#)[Interference Message
Status](#)[Logout](#)

Frequency Request Message

RADIO SYSTEM

Fill in the new frequency request message information into the related fields.

Personal Information :

Name Surname : Unit Name : Grade : Phone Number :

System and Assignment Information

National Registration
Number : Service Code : Beginning Date of Usage : User Code : End Date of Usage : Circuit Number : Requested Frequency Count : ☒ Actual ☐ SpareCircuit Type : Fill in the number of requested actual
and spare frequency into the related fields.Description : Circuit Category : Working Time : Carrier Frequency : Security Level :

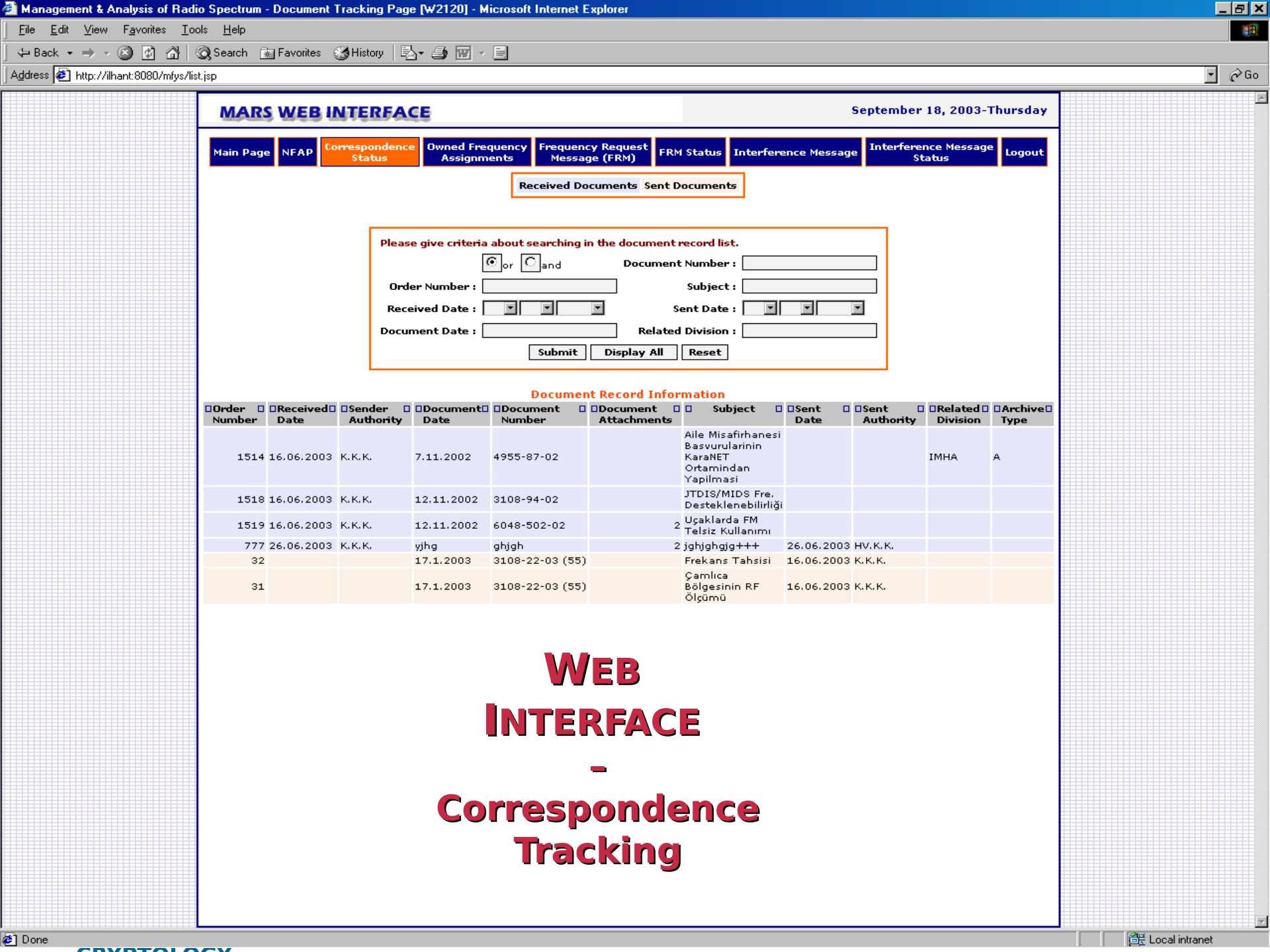
Inventory Information

Please select the station from the list, if the station is not listed define a new station.

Station :

New Station Information

Station Name : Station Type :



MARS WEB INTERFACE

September 18, 2003-Thursday

[Main Page](#) [NFAP](#) [Correspondence Status](#) [Owned Frequency Assignments](#) [Frequency Request Message \(FRM\)](#) [FRM Status](#) [Interference Message](#) [Interference Message Status](#) [Logout](#)

[Received Documents](#) [Sent Documents](#)

Please give criteria about searching in the document record list.

☒ or ☐ and

Document Number :

Order Number :

Subject :

Received Date :

Sent Date :

Document Date :

Related Division :

Document Record Information

☐ Order Number	☐ Received Date	☐ Sender Authority	☐ Document Date	☐ Document Number	☐ Document Attachments	☐ Subject	☐ Sent Date	☐ Sent Authority	☐ Related Division	☐ Archive Type
1514	16.06.2003	K.K.K.	7.11.2002	4955-87-02		Aile Misafirhanesi Basvurularinin KaraNET Ortamindan Yapilmasi			IMHA	A
1518	16.06.2003	K.K.K.	12.11.2002	3108-94-02		JTDIS/MIDS Fre. Desteklenebilirliđi				
1519	16.06.2003	K.K.K.	12.11.2002	6048-502-02		2 Uçaklarda FM Telsiz Kullanımı				
777	26.06.2003	K.K.K.	yjhg	ghgh		2 jghjghgig+++	26.06.2003	HV.K.K.		
32			17.1.2003	3108-22-03 (55)		Frekans Tahsisi	16.06.2003	K.K.K.		
31			17.1.2003	3108-22-03 (55)		Çamlıca Bölgesinin RF Ölçümü	16.06.2003	K.K.K.		

**WEB
INTERFACE
-
Correspondence
Tracking**



REPORTS



MARS - DBMS

- ☐ Frequency allotment, assignment lists
- ☐ Station lists and equipment lists

MARS - SMAS

- ☐ Signal level, Coverage (service) area and line of sight (LOS) plots
- ☐ Station lists obtained by queries from the database
- ☐ Interference lists
 - ☐ interfering stations
 - ☐ interfered stations
 - ☐ interference percentages (in terms of coverage areas, statistically)
- ☐ Frequency Nomination lists

OVER THE WEB

- ☐ Monitoring of frequency assignments for Force, Army, Corp, Brigade
- ☐ Message browser (freq. request, freq. assign., interf. reports etc.)



TRAINING PROGRAM



MARS - Overview

- ☐ Administrator Setup and Maintenance training program
- ☐ Spectrum Management Basics

MARS - DBMS Short Courses

- ☐ DBMS User Training
- ☐ Database Management Systems
- ☐ Server/Client Structures
- ☐ Web applications

MARS - SMAS Short Courses

- ☐ SMAS User Training
- ☐ Communications Systems
- ☐ Electromagnetic wave propagation and scattering
- ☐ LF/MF Systems
- ☐ HF Systems
- ☐ Radar systems theory
- ☐ Geographical Information Systems
- ☐ Satellite systems

+ Customized Short

Courses

COMBINED ENDEAVOR 2004



QUALITY MANAGEMENT



NRIEC Quality Management Programs :

- ☐ **ISO 9001:2000 Quality System Certification**
- ☐ **NATO AQAP 110 Industrial Quality Assurance Certification**
- ☐ **IEEE 12207 based Software Quality Management System**

Software Quality Management Tools :

- ☐ **Configuration Management Tool**
- ☐ **Requirements Management Tool**
- ☐ **Test Management Tool (DBMS)**

Graphical User Interface standards :

- ☐ **T.G.S. K.K.B.S. Projects Man and Machine Interface standards.**
- ☐ **Microsoft User Interface compliant look and feel.**

Java based DataBase Management Software:



SPECTRUM MANAGEMENT CONCEPT AUTOMATION



MAN - MACHICE INTERFACE

- ☐ WEB interface
- ☐ Geographical Information System
- ☐ Graphical User Interface

ENGINEERING TOOLS

- ☐ Freq. Band: LF/MF/HF/VHF/UHF
- ☐ Point to point / Radio network analysis
- ☐ Coverage / Signal level contours
- ☐ Interference relationships, %s and lists

- ☐ Automatic frequency nomination
- ☐ Spectrum occupancy

MACHINE- MACHICE INTERFACE

Data exchange with;

- ☐ ARCADE (SMADEF)
- ☐ Spectrum XXI (SFAF)

WEB to DBMS / DBMS to WEB interface

DATABASE MANAGEMENT TOOLS

- ☐ MARS database on ORACLE

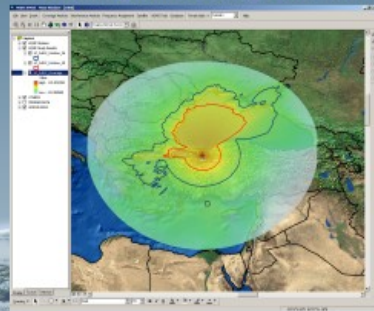
Evaluation criteria defined by
NATO's Frequency
Management Sub-Committee

COMBINED ENDEAVOR 2004

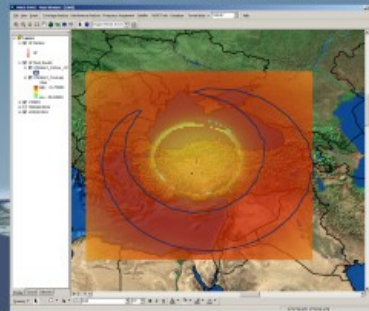
Coverage Analysis

✦ Communication Systems

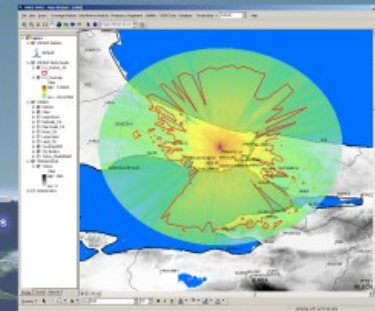
Coverage field can simply be defined as the service area corresponding to a transmitter system. It is also defined as the region where a receiver is guaranteed to receive the minimum signal level required for sufficient quality of communication (for radar systems; the sufficient signal level received at the radar receiver due to a given target). For coverage area calculations, MARS users can utilize various propagation models, including the ITU's Recommendations and various empirical methods for RMD (Reflection and Multiple Diffraction) calculations. The received power level (or the transmitted power level) at the receiver location can be displayed on the map via GIS (Geographical Information System) using user-friendly color coding format. Multiple coverage contours corresponding to different receiver sensitivities can be displayed simultaneously.



- ✦ Ground-Wave Analysis
- ✦ Sky-Wave Analysis
- ✦ Land-Sea Effects
- ✦ Transmitter/Receiver Antenna Patterns
- ✦ Seasonal and Temporal Variations
- ✦ Database Query Interface



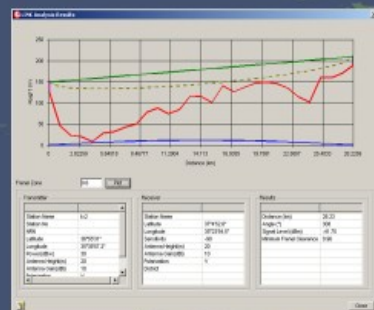
- ◆ Sky-Wave Analysis
- ◆ Ionospheric Effects
- ◆ Transmitted/Receiver
- ◆ Seasonal and Temporal Variations
- ◆ Database Query Interface



- Terrain Effects / Diffraction
- Land-Sea Effects
- Atmospheric Effects
- Location/Time
- Percentage Variations
- Transmitter/Receiver
- Antenna Patterns
- Database Query Interface

◆ Link Systems

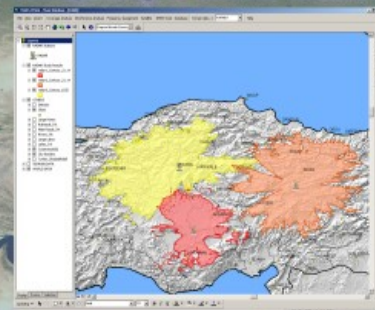
Performance evaluation of the terrestrial microwave link systems by calculation of Line of Sight (LOS) and Fresnel region(s) and the signal level at the receiver and plotting of the terrain profile via GIS (Geographical Information System)



- ◆ Terrain Effects / Diffraction
- ◆ Atmospheric Effects
- ◆ Distance/Azimuth/Terrain Profile
- ◆ LOS
- ◆ Fresnel Regions
- ◆ Transmitter/Receiver
- ◆ Antenna Patterns
- ◆ Database Query Interface

✦ Radar Systems

The signal intensity received at the radar receiver due to a given target is calculated. The target parameters, RCS, altitude, etc. are used. The results are plotted on the map via GIS (Geographical Information System) using user-friendly color coding format. Multiple coverage contours corresponding to different receiver sensitivities and/or different targets can be displayed simultaneously.



- ◆ Radar
 - ◆ Terrain Effects / Diffraction
 - ◆ Atmospheric Effects
 - ◆ Multipath Effects
 - ◆ Target Parameters (RCS, altitude, etc.)
 - ◆ Transmitter/Receiver Antenna Patterns
 - ◆ Database Query Interface

Interference Analysis

Interference is observed when the quality of operation for an interfered station deteriorates below a minimum level due to receiving an unintentional signal emitted by an interfering transmitter(s). In the interference analysis, the interfered and the interfering stations are detected, the interfering/interfered area percentages are calculated and the results are formatted into an interference (relationship) table, automatically. The interference tables are calculated using the system parameters, geographical parameters, atmospheric effects and the frequency band. The results can be saved into a file for future reference. In the interference analysis, the list of possible interfering stations are detected, coverage areas for each station are calculated, interference tables are constructed and the results are used into calculating the list of frequency channels acceptable for assignment for the new station, all automatically. Interference analysis can be executed for a list of stations which is constructed automatically by database query and/or by the user manually.

Systems

- ◆ Communication Systems
 - ◆ LF/MF
 - ◆ HF
 - ◆ V/UHF
- ◆ Radar Systems
- ◆ Link Systems

NSM - Interference Analysis Results - [2002]

Interfered St. Name	Interference(%)
tx2	50
tx15	75
tx6	70
tx12	70
tx7	55
tx9	55
tx16	55
tx5	50
tx14	50
tx1	45
tx3	25
tx13	20
tx8	0
tx10	0
tx11	0

Interfering St. Name	Interference(%)
tx1	65
tx2	0
tx3	65
tx4	0
tx5	75
tx6	20
tx7	0
tx8	0
tx9	0
tx10	0
tx11	0
tx12	0
tx13	0
tx14	0
tx15	0
tx16	0

Close

- ◆ Co-Channel / Adjacent Channel Effects
- ◆ Operating Hours
- ◆ Assignment Categories (Peacetime, Field Trials, Wartime, etc.)
- ◆ Interfering / Interfered Area Percentages
- ◆ Interfering / Interfered System Lists
- ◆ Transmitter / Receiver Antenna Patterns
- ◆ Database Query Interface

INTERFERENCE ANALYSIS RESULT TABLE

Frequency Assignment Analysis

In the frequency assignment analysis, the list of frequency channels acceptable for assignment are determined for a new (proposed) station. The software searches for the frequency channels where no interference is expected. The new station operating at those frequency channels is expected to be neither the interfering nor the interfered station. In the frequency assignment analysis, the list of possible interfering stations are detected, coverage areas for each station are calculated, interference tables are constructed and the results are used into calculating the list of frequency channels acceptable for assignment for the new station, all automatically.

Systems

- ◆ Communication Systems
 - ◆ LF/MF
 - ◆ HF
 - ◆ V/UHF
- ◆ Radar Systems
- ◆ Link Systems

Frequency Assignment Table - [2001]

Station Order	Assign. Freq.(MHz)	TGP	In Use	New St. Interf.(%)	Interfering Pwr.(dB)
12	902	...	...	0	0
11	901.8	...	...	0	0
10	901.6	...	...	0	0
9	901.4	...	...	0	0
8	901.2	...	...	0	0
17	901.8	...	...	25	30
7	901.6	...	...	0	0
6	901.4	...	...	0	0
5	901.2	...	...	0	0
26	901.1	...	...	0	0
31	901	...	...	25	30
29	900.8	...	...	0	0
13	900.8	...	...	25	10
15	900.7	...	...	40	5
22	900.6	...	...	65	145
23	900.6	...	...	100	190
16	900.4	...	...	60	65
18	900.3	...	...	25	30
21	900.2	...	...	75	115
25	900.1	...	...	75	120
19	900	...	...	75	70
14	899.9	...	...	40	0
4	899.5	...	...	0	0
3	899.7	...	...	0	0

Frequency = 100.1 MHz

Station Name	Interference(%)	Station Name	Interference(%)
tr1	40	tr1	0
tr2	0	tr2	0
tr3	75	tr3	10
tr4	75	tr4	65
tr5	40	tr5	5
tr6	0	tr6	10
tr7	0	tr7	0
tr8	0	tr8	0
tr9	0	tr9	0
tr10	0	tr10	0
tr11	0	tr11	0
tr12	0	tr12	0
tr13	0	tr13	0
tr14	15	tr14	10
tr15	0	tr15	0
tr16	0	tr16	0

Close Details OK

FREQUENCY ASSIGNMENT RESULT TABLE

- ◆ Co-Channel / Adjacent Channel Effects
- ◆ Joint Restricted Frequency List Data (Taboo / Protected / Guarded Frequencies)
- ◆ Operating Hours
- ◆ Assignment Categories (Peacetime, Field Trails, Wartime, etc.)
- ◆ Interfering / Interfered Area Percentages
- ◆ Interfering / Interfered System Lists
- ◆ Frequency Nomination
- ◆ Transmitter / Receiver Antenna Patterns
- ◆ Database Query Interface



MANAGEMENT AND ANALYSIS OF RADIO SPECTRUM

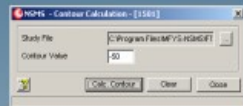


TÜBİTAK UEKAE
İLTAREN Research Group

Other Calculations

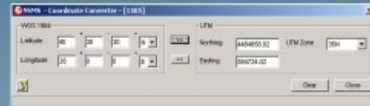
Engineering Tools

Contour Plots



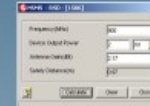
Using the results of the corresponding coverage analysis results, the region in which the signal level exceeds a specific value is calculated and displayed on map as closed curves (contours).

Coordinate Converter



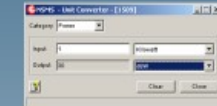
The coordinate conversion between geographical and UTM coordinate systems are performed.

Radiation Safety Distance



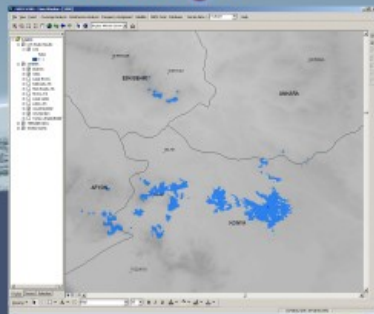
The radiation safety distance is calculated in accordance with the related regulations.

Unit Converter



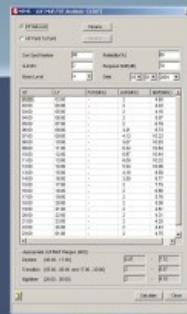
The conversion between units are performed for various categories such as distance, power, frequency, etc.

Line of Sight



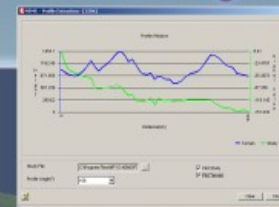
The area where an observer of specific height can see an observed target with a given height is calculated and displayed as a closed contour on the map.

HF LUF / MUF / FOT



LUF/MUF/FOT values for HF communication systems, operating in a point to point or a network scenario, are calculated as a function of hour.

Terrain / Signal Profile



Signal levels produced by the transmitter are read from a pre-conducted coverage analysis and plotted with respect to the distance from the transmitter along a selected azimuth. The related terrain height profile may also be superimposed on the graph.

Azimuth / Distance Reckoning

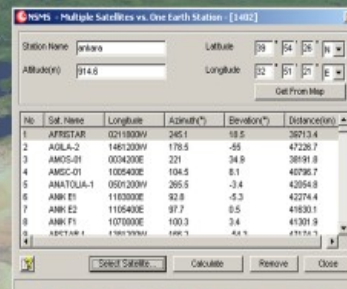


Given their coordinates, the distance and azimuth between two points are calculated. The coordinates of a point with a given distance and azimuth from a specified point are calculated.

Satellite Analyses

Look Angle

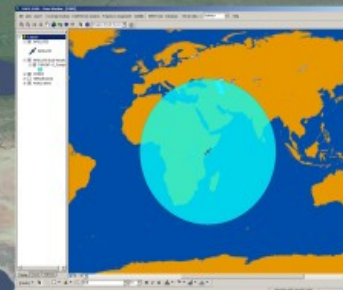
The elevation and azimuth angles, and distance between the geo-stationary satellites and ground stations are calculated.



No.	Sat. Name	Longitude	Azimuth(*)	Elevation(*)	Distance(km)
1	AFRISTAR	02113000N	245.1	58.5	38713.4
2	AGLA-2	14612000N	178.5	-55	47220.7
3	AMOS-01	0004200E	221	34.9	39191.9
4	AMSC-01	1005400E	104.5	8.1	40796.7
5	ANATOLIA-1	05012000N	265.5	-3.4	42054.8
6	ANK E1	1103000E	92.8	-5.3	42274.4
7	ANK E2	1105400E	97.7	8.5	41938.1
8	ANK F1	1071000E	100.3	3.4	41301.9
9	ABSTAR 1	17001000N	698.7	6.4	47172.7

Footprint Analysis

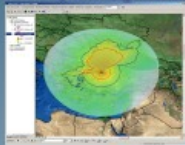
The area on the world that can be seen by a satellite is calculated and plotted on map.



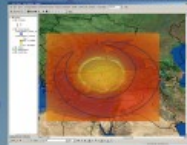
Coverage Analysis

Communication Systems

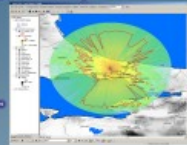
Coverage field can simply be defined as the service area corresponding to a transmitter system. It is also defined as the region where a receiver is guaranteed to receive the minimum signal level required for sufficient quality of communication (for radar systems: the sufficient signal level received at the radar receiver due to a given target). For coverage area calculations, MARS users can utilize various propagation models, including the ITU's Recommendations and various empirical methods for RMD (Reflection and Multiple Diffraction) calculations. The received power level (or the transmitted power level) at the receiver location can be displayed on the map via GIS (Geographical Information System) using user-friendly color coding format. Multiple coverage contours corresponding to different receiver sensitivities can be displayed simultaneously.



Search Area Analysis
Line-of-Sight Effects
Atmospheric Effects
Antenna Patterns
Database Query Interface



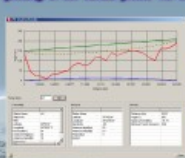
Search Area Analysis
Line-of-Sight Effects
Atmospheric Effects
Antenna Patterns
Database Query Interface



Search Area Analysis
Line-of-Sight Effects
Atmospheric Effects
Antenna Patterns
Database Query Interface

Link Systems

Performance evaluation of the terrestrial microwave link systems by calculation of Line of Sight (LOS) and Fresnel region(s) and the signal level at the receiver and plotting of the terrain profile via GIS (Geographical Information System).



Search Area Analysis
Line-of-Sight Effects
Atmospheric Effects
Antenna Patterns
Database Query Interface

Radar Systems

The signal intensity received at the radar receiver due to a given target is calculated. The target parameters (RCS, altitude, etc.) are used. The results are plotted on the map via GIS (Geographical Information System) using user-friendly color coding format. Multiple coverage contours corresponding to different receiver sensitivities and/or different targets can be displayed simultaneously.



Search Area Analysis
Line-of-Sight Effects
Atmospheric Effects
Antenna Patterns
Database Query Interface



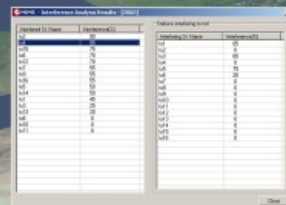
Search Area Analysis
Line-of-Sight Effects
Atmospheric Effects
Antenna Patterns
Database Query Interface

Interference Analysis

Interference is observed when the quality of operation for an interfered station deteriorates below a minimum level due to receiving an unintentional signal emitted by an interfering transmitter(s). In the interference analysis, the interfered and the interfering stations are detected, the interfering/interfered area percentages are calculated and the results are formatted into an interference (relationship) table, automatically. The interference tables are calculated using the system parameters, geographical parameters, atmospheric effects and the frequency band. The results can be saved into a file for future reference. In the interference analysis, the list of possible interfering stations are detected, coverage areas for each station are calculated, interference tables are constructed and the results are used into calculating the list of frequency channels acceptable for assignment for the new station, all automatically. Interference analysis can be executed for a list of stations which is constructed automatically by database query and/or by the user manually.

Systems

- Communication Systems
- LF/MF
- HF
- V/UHF
- Radar Systems
- Link Systems



INTERFERENCE ANALYSIS RESULTS TABLE

- Co-Channel / Adjacent Channel Effects
- Operating Hours
- Assignment Categories
- Interfering / Interfered Area Percentages
- Interfering / Interfered System Lists
- Transmitter / Receiver Antenna Patterns
- Database Query Interface

Other Calculations

Engineering Tools

Contour Plots

The results of the calculations are displayed as contour plots on the map via GIS (Geographical Information System) using user-friendly color coding format.



CONTOUR PLOTS RESULTS TABLE

Coordinate Converter

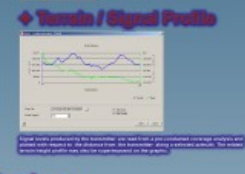
The coordinate converter can convert the coordinates from one system to another system.



COORDINATE CONVERTER RESULTS TABLE

Radiation Safety Distances

The radiation safety distances are calculated in accordance with the ITU-R Recommendation.



RADIATION SAFETY DISTANCES RESULTS TABLE

Unit Converter

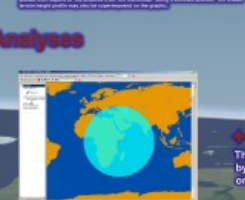
The unit converter can convert the units from one system to another system.



UNIT CONVERTER RESULTS TABLE

Terrain / Signal Profile

The terrain and signal profiles are calculated and plotted on the map via GIS (Geographical Information System) using user-friendly color coding format.



TERRAIN / SIGNAL PROFILE RESULTS TABLE

Altitude / Distance

The altitude and distance are calculated and plotted on the map via GIS (Geographical Information System) using user-friendly color coding format.

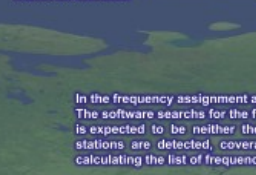


ALTITUDE / DISTANCE RESULTS TABLE

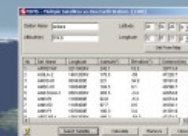
Satellite Analyses

Look Angle

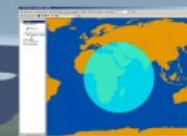
The elevation and azimuth angles, and distance between the geo-stationary satellites and ground stations are calculated.



LOOK ANGLE RESULTS TABLE



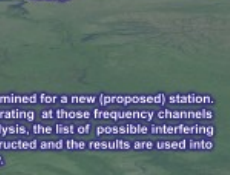
SATELLITE ANALYSES RESULTS TABLE



SATELLITE ANALYSES RESULTS TABLE

Footprint Analysis

The area on the world that can be seen by a satellite is calculated and plotted on map.



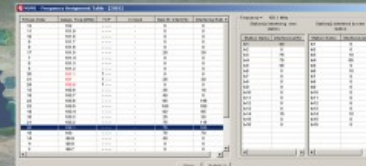
FOOTPRINT ANALYSIS RESULTS TABLE

Frequency Assignment Analysis

In the frequency assignment analysis, the list of frequency channels acceptable for assignment are determined for a new (proposed) station. The software searches for the frequency channels where no interference is expected. The new station operating at those frequency channels is expected to be neither the interfering nor the interfered station. In the frequency assignment analysis, the list of possible interfering stations are detected, coverage areas for each station are calculated, interference tables are constructed and the results are used into calculating the list of frequency channels acceptable for assignment for the new station, all automatically.

Systems

- Communication Systems
- LF/MF
- HF
- V/UHF
- Radar Systems
- Link Systems



FREQUENCY ASSIGNMENT RESULTS TABLE

- Co-Channel / Adjacent Channel Effects
- Joint Restricted Frequency List Data (Taboo / Protected / Guarded Frequencies)
- Operating Hours
- Assignment Categories (Peacetime / Field Trials / Wartime, etc.)
- Interfering / Interfered Area Percentages
- Interfering / Interfered System Lists
- Frequency Nomination
- Transmitter / Receiver Antenna Patterns
- Database Query Interface



CURRENT PROJECTS



DBMS v3.0

August 2004]

[planned to be available in

Complete SMADEF Compatibility

- ☐ **SMADEF compatible messaging**
- ☐ ***SMADEF Forever* component**
(forward compatibility to future SMADEF updates by flexible formatted messaging interface)

-
- ☐ **Additional compatibility to DB structure recommended by ITU**

SMAS v3.0

July 2004]

[planned to be available in

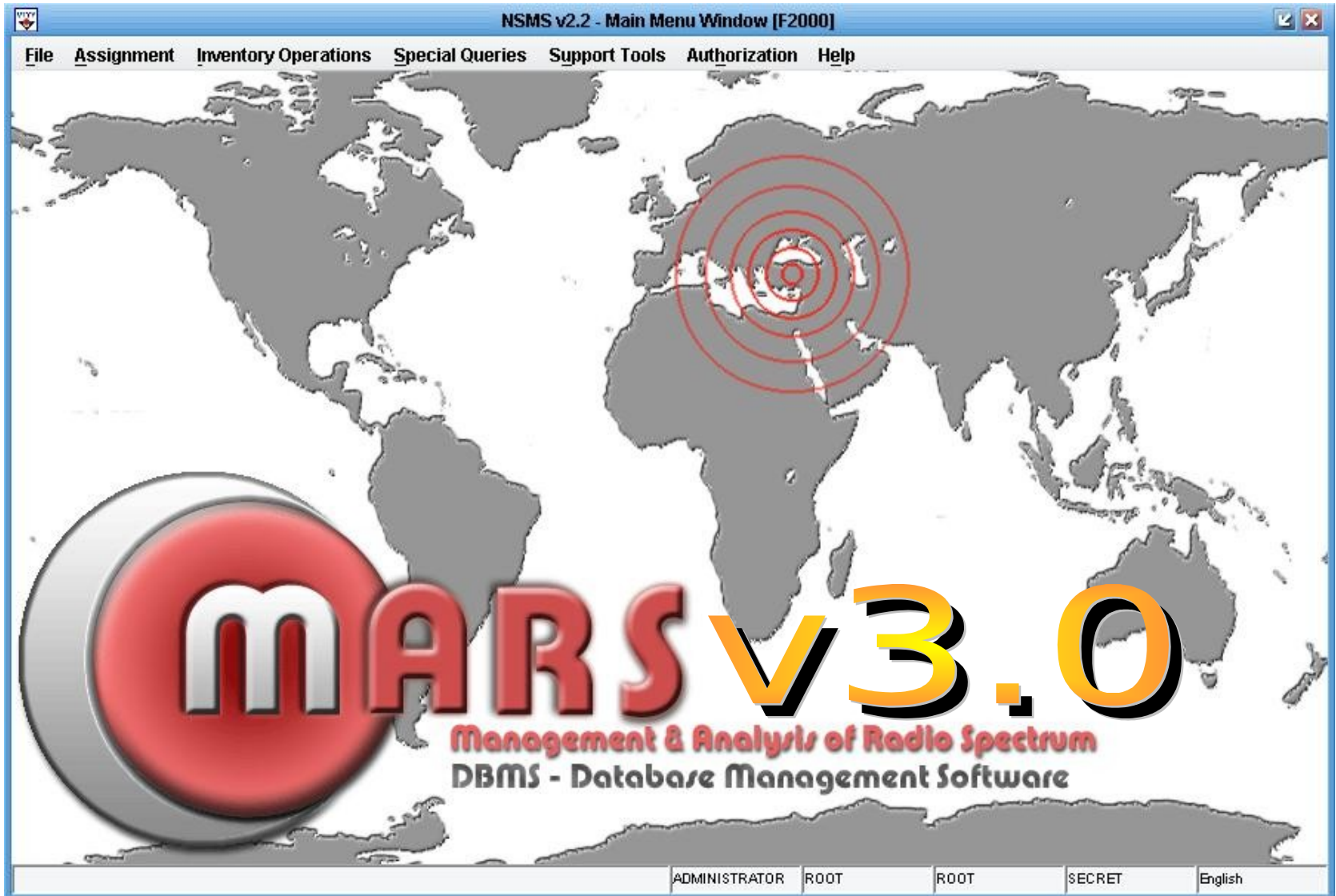
Digital Systems Modelling & Analysis [DAB, DVB]

Advanced Cosite analysis and introduction of new prop. curves

-
- ☐ ~~Intermodulation analysis, Desensitization analysis~~
 - ☐ **ITU's recent Recommendation R.1546; new propagation curves**
 - ☐ **Antenna pattern analysis**
 - ☐ **Optimized computations for even faster results**
-



DATABASE MANAGEMENT SYSTEM



DBMS v3.0 NEW FEATURES



- 1. Improvements on User Interface**
- 2. Frequency Assignment Wizard**
 - ✓ Easy to handle step by step frequency assignment generation process
- 3. Integration with SMAS**
 - ✓ Database – GIS integration: Visualization of the stations, records, etc. on GIS
- 4. SMADEF & ITU compatible database**
 - ✓ Extending the database design to include all SMADEF & ITU fields

5. SMADEF Compatible Messaging

SMADEF Message

- ✓ Generation
- ✓ Visualization
- ✓ Integration

6. *SMADEF Forever* Component

- ✓ Ability to adapt possible future changes of SMADEF messaging format

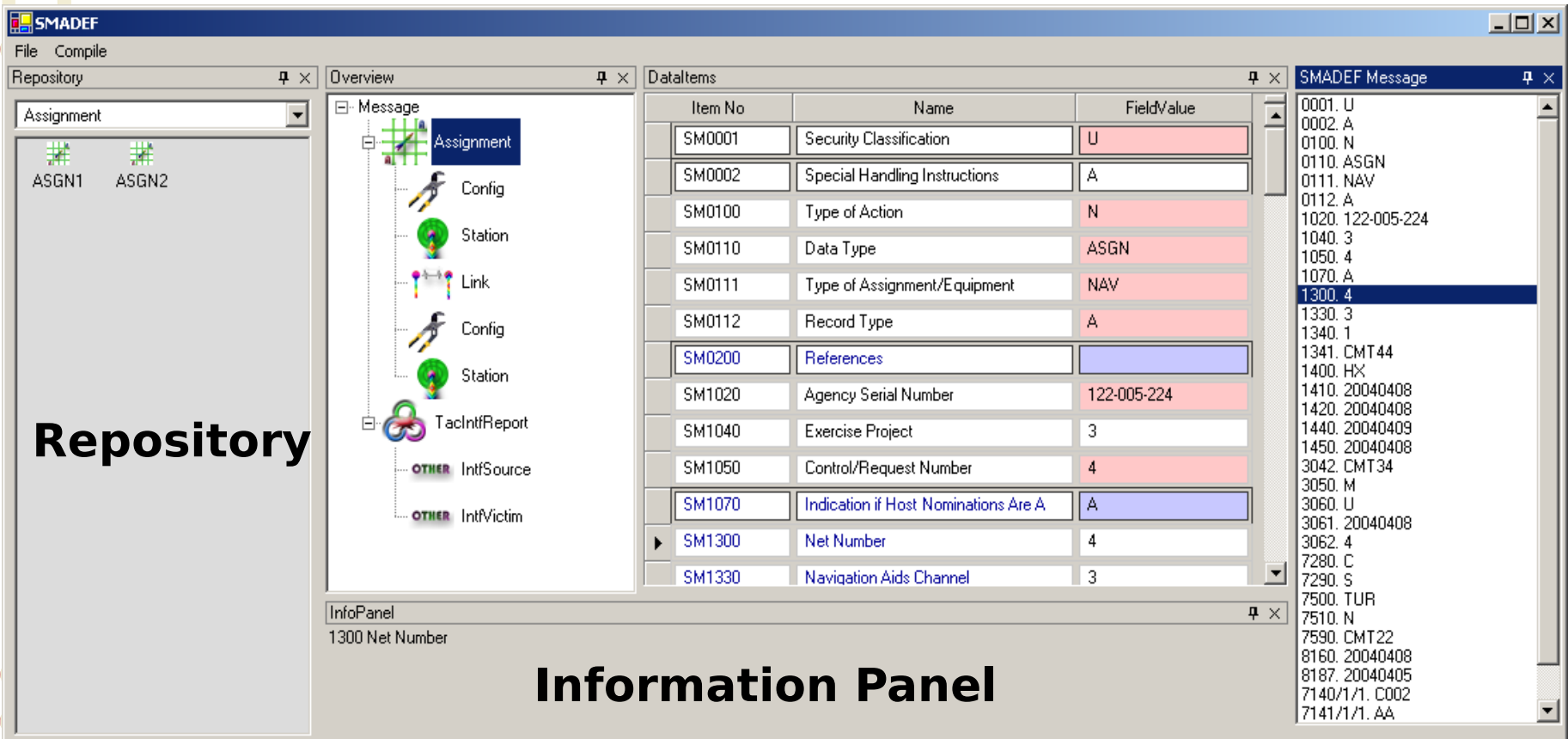
7. Improvements on Report Generation

- ✓ Enhanced reporting features

DBMS v3.0 NEW FEATURES

SMADEF Forever Message Interface

Message Tree View Data Entry Section



The screenshot displays the SMADEF Message Interface, which is divided into several sections:

- Repository:** Located on the left, it shows a tree view of the message structure. The 'Assignment' node is selected, and its sub-nodes (ASGN1, ASGN2) are visible.
- Overview:** This panel shows a hierarchical view of the message structure. The 'Message' node is selected, and its sub-nodes (Config, Station, Link, Config, Station, TacIntReport, IntfSource, IntfVictim) are listed.
- DataItems:** This panel displays a table of data items. The table has three columns: Item No, Name, and FieldValue. The data items are as follows:

Item No	Name	FieldValue
SM0001	Security Classification	U
SM0002	Special Handling Instructions	A
SM0100	Type of Action	N
SM0110	Data Type	ASGN
SM0111	Type of Assignment/Equipment	NAV
SM0112	Record Type	A
SM0200	References	
SM1020	Agency Serial Number	122-005-224
SM1040	Exercise Project	3
SM1050	Control/Request Number	4
SM1070	Indication if Host Nominations Are A	A
SM1300	Net Number	4
SM1330	Navigation Aids Channel	3
- SMADEF Message:** This panel on the right displays the message text. The message is a standard NATO message format, starting with '0001. U' and ending with '7141/1/1. AA'.
- Information Panel:** Located at the bottom, it displays the '1300 Net Number'.



DBMS v3.0 NEW FEATURES



SMADEF Forever Message Interface Multiple Entries

SMADEF

File Compile

Repository

Assignment

ASGN1 ASGN2

Overview

Message

Assignment

Config

Station

Link

Config

Station

TacIntfReport

OTHER IntfSource

OTHER IntfVictim

DatItems

Item No	Name	FieldValue
SM0112	Record Type	A
SM0140	02/04/2004	03/04/2004
SM0141	AACA	AADA
SM0142	UEKAE	ILTRN
SM0150	ADD ... SM0140	
SM0160	Original Classification Authority	
SM0180	Original Classification Authority Orga	
SM0181	Reason for Classification	
SM0190	References	
SM0200	Record Indicator	
SM1030	Agency Serial Number	
SM1020	Exercise Project	

SMADEF Message

0001. U
0100. N
0110. ASGN
0112. A
0140/1/1. 20040402
0141/1/1. AACA
0142/1/1. UEKAE
0140/2/1. 20040403
0141/2/1. AADA
0142/2/1. ILTRN

InfoPanel

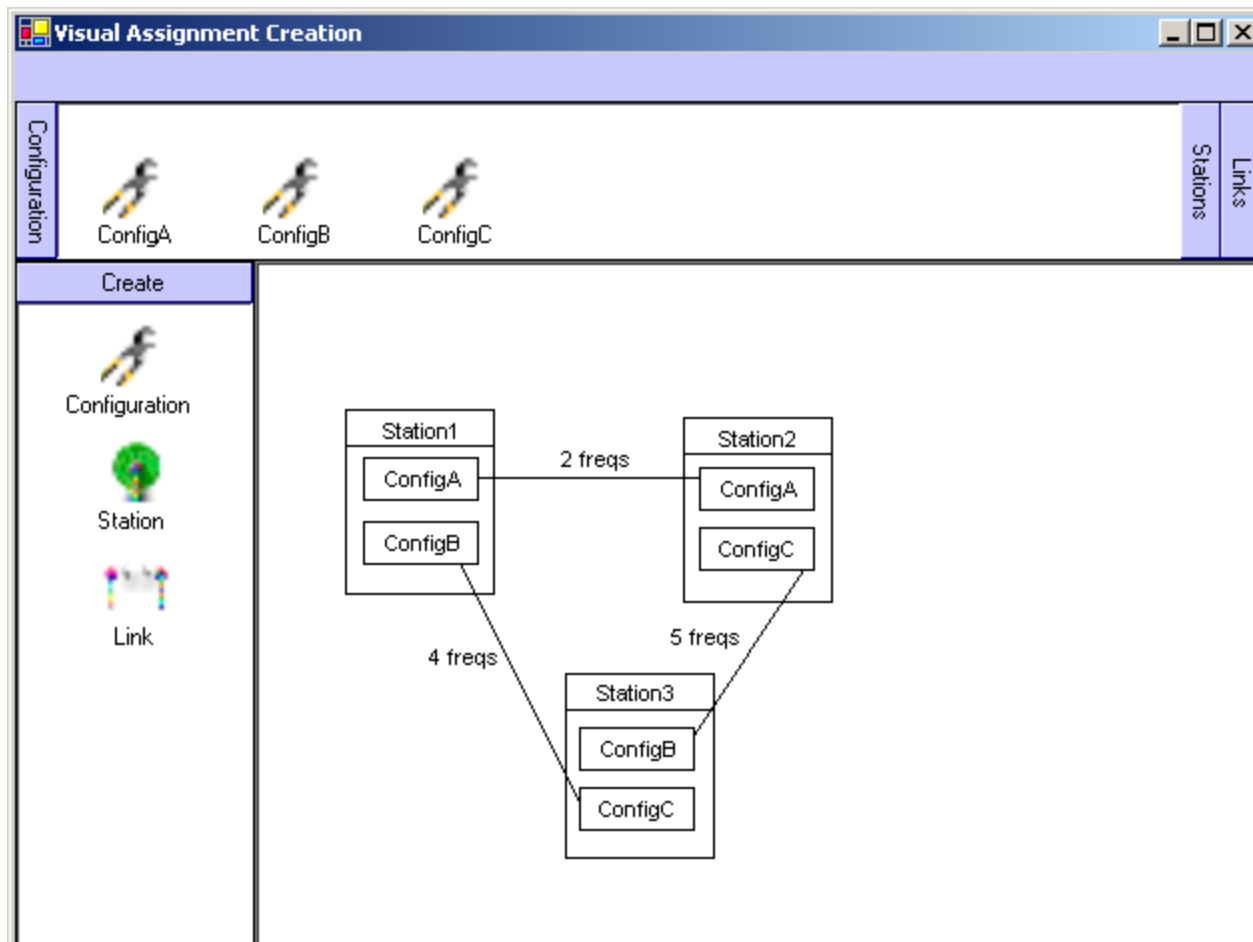
0140 Derivative Classification Date



DBMS v3.0 NEW FEATURES



SMADEF Forever Message Interface **Message Visualization**

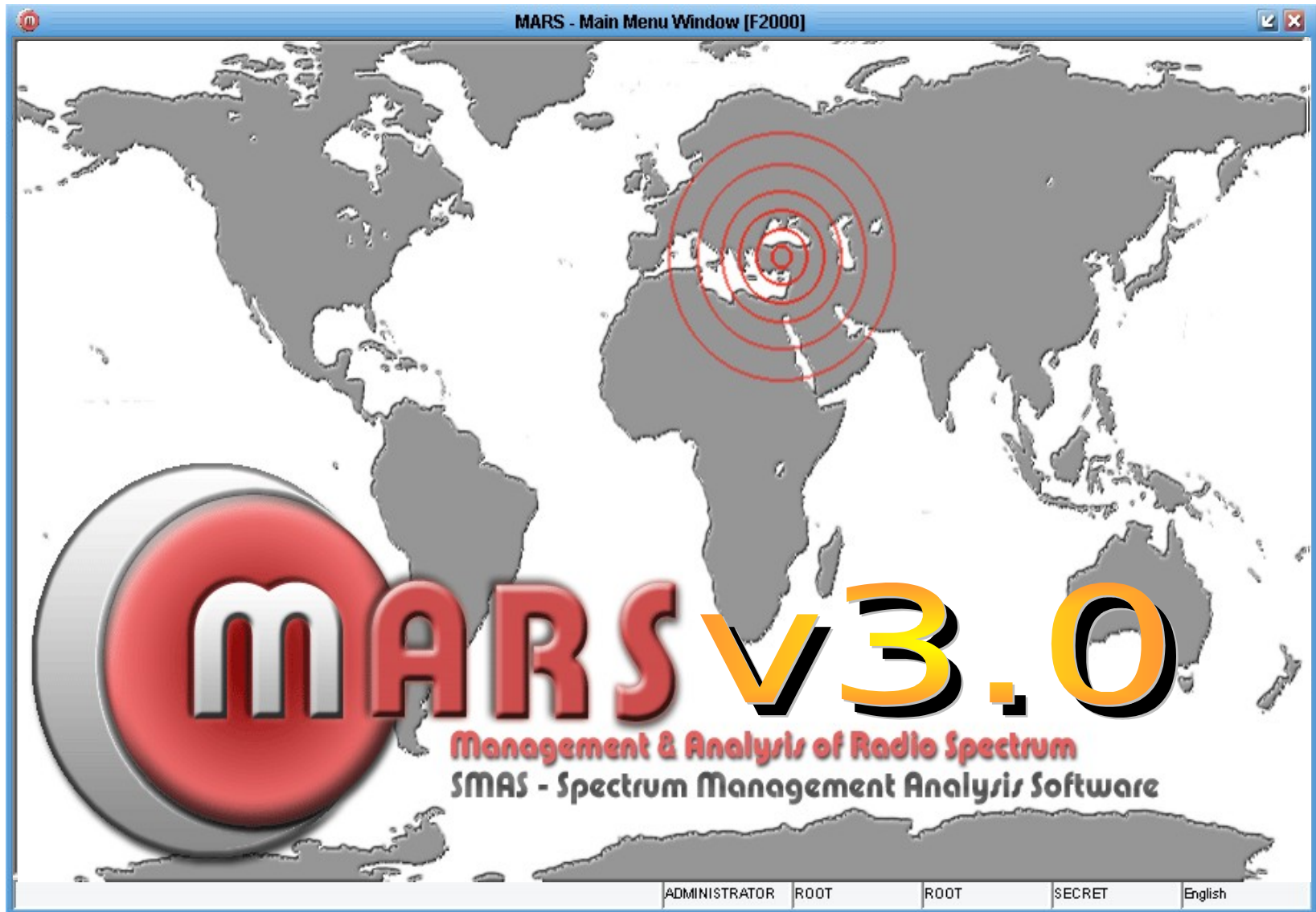




SPECTRUM MANAGEMENT AND ANALYSIS



COMBINED ENDEAVOR 2004





SMAS v3.0 FEATURES



1. Digital Systems Modelling & Analysis

- ✓ T-DAB – Terrestrial Digital Audio Broadcasting
- ✓ DVB-T – Terrestrial Digital Video Broadcasting

2. ITU-R P.1546 Propagation Model

V/UHF propagation model superseding ITU-R P.370

3. Cost-Benefit Analysis

- ✓ Specialized FM for hybrid Digital/Analog spectrum usage

4. New Diffraction Models

- ✓ Giovaneli
- ✓ Vogler

in addition to existing Epstein and Deygout models.



SMAS v3.0 FEATURES



4. Cosite Analysis

- ✓ Intermodulation Analysis
- ✓ Desensitization Analysis

5. Enhanced User Interface Features

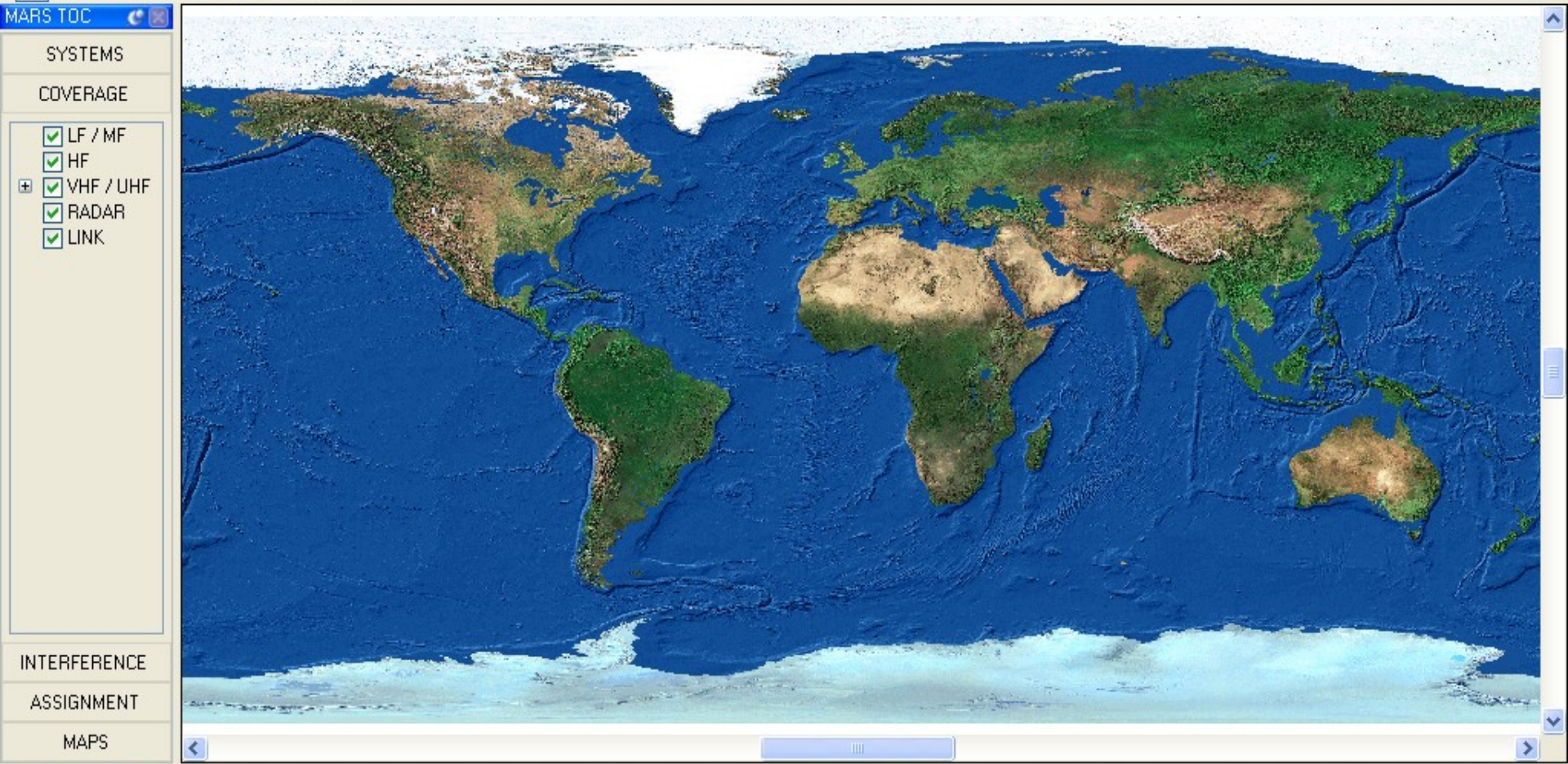
- ✓ Easy to use and manage system lists
- ✓ Full GIS integration

6. Optimized Computations for Even Faster Results

- ✓ DLL routine optimizations
- ✓ More efficient analysis algorithms

7. Antenna Pattern Visualization

- ✓ Visual inspection of antenna pattern files
- ✓ Vertical & Horizontal pattern views



MARS Device View

Stations

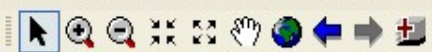
Selection

Show

Stations		Administrative								
Active	StationID	Security Classificatio	Frequency Assignment N	Country	User	Usage Cod	J	Frequency (MHz)	Frequency Upper Limit (MHz)	
☐	st1	U		TUR	TK	war/peace	No	100	150	
☒		U		TUR	TK	war/peace	No	100	150	
☒	st3					war/peace	No			

LINK

UHF/VHF



MARS TOC

SYSTEMS

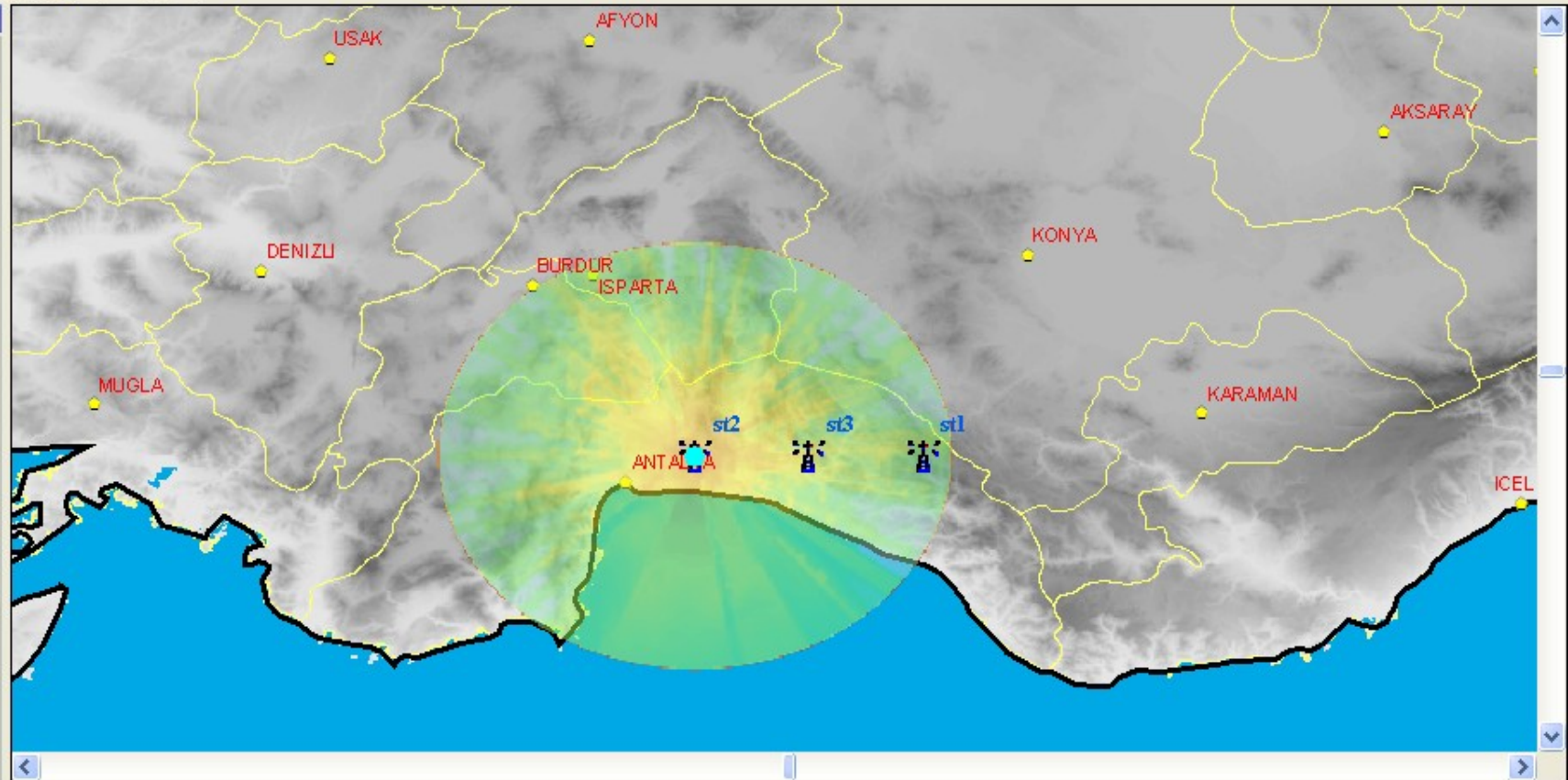
- ☒ LF / MF
- ☒ HF
- ☒ VHF / UHF
- ☒ VHF / U
- ☒ RADAR
- ☒ LINK

COVERAGE

INTERFERENCE

ASSIGNMENT

MAPS



MARS Device View

Stations										
Stations				Administrative						
Active	StationID	Security Classificatio	Frequency Assignment N	Country	User	Usage Cod	J	Frequency (MHz)	Frequency Upper Limit (MHz)	
☐	st1	U		TUR	TK	war/peace	No	100	150	
☒		U		TUR	TK	war/peace	No	100	150	
☐	st3					war/peace	No			

MANAGEMENT AND ANALYSIS OF RADIO SPECTRUM

COMPARATIVE STUDY ON ITU-R P.370 & ITU-R P.1546 PROPAGATION CURVES

COMPARISONS



- 1. Input Parameters**
- 2. Propagation Curves**
- 3. Coverage on terrain**



COMPARISONS ON THE INPUT PARAMETERS

INPUT PARAMETERS

REC.370 REC.1546

h_1 ✓ Yes

h_2 ✓ Yes

Freq ✓ Yes

Path Type ✓ Yes

Time % ✓ Yes

Location % ✓ Yes

Rx. Location Type ✓ Yes

TCA Correction ✓ Yes

Analog/Digital trans. ✓ Yes

Delta H Correction **NO**

h_1 [-

[10

- 20

37.5 37.5

75 75

150 150

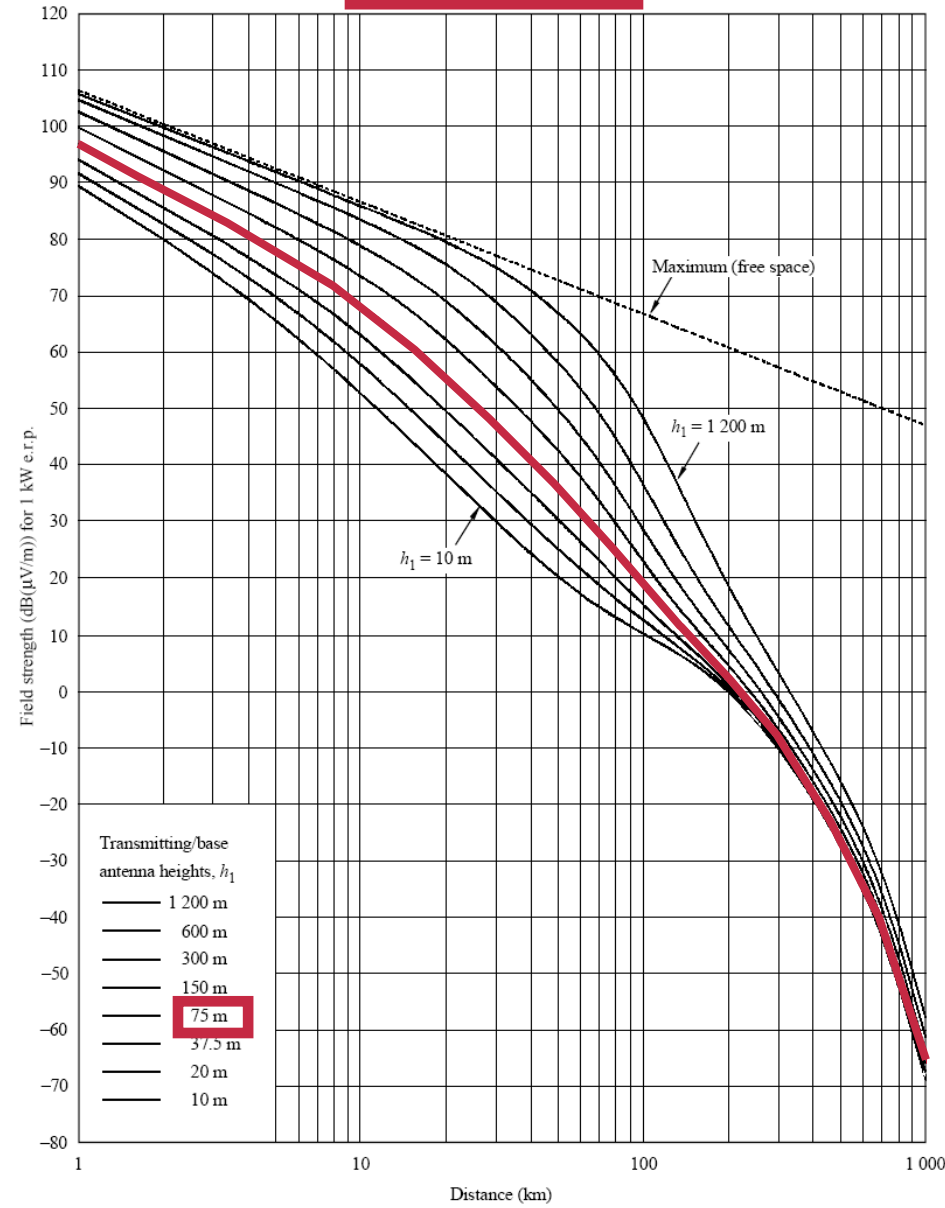
300 300

600 600

1 200 1

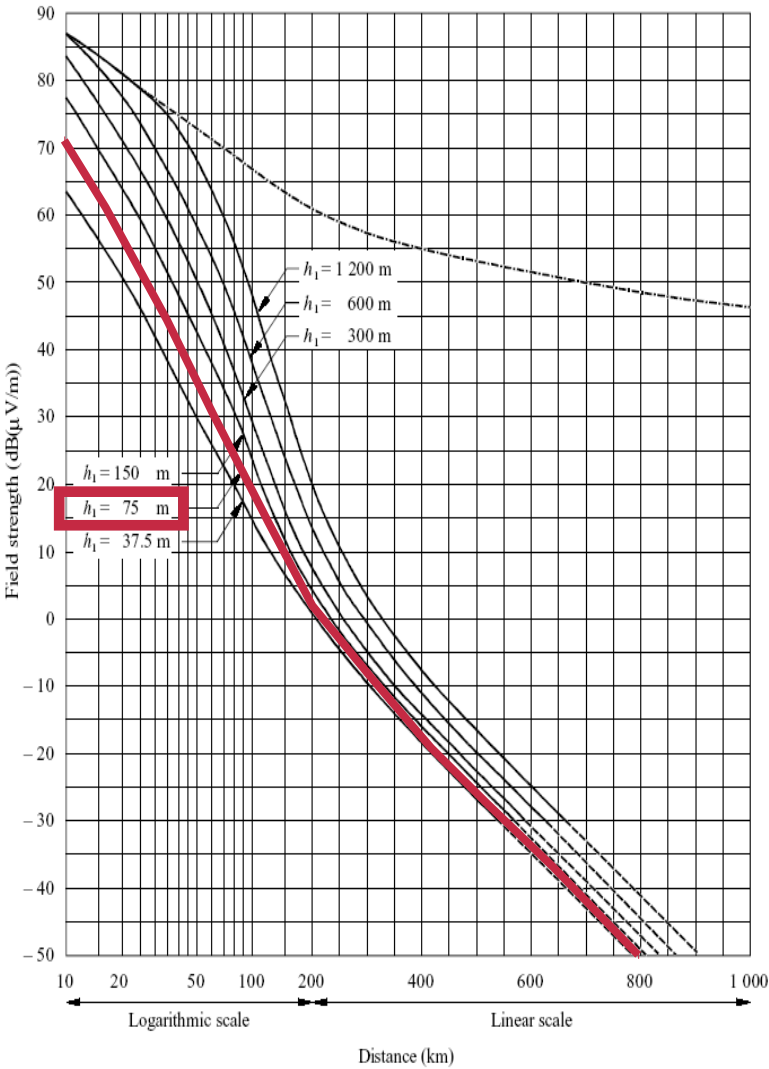
1.2001

FIGURE 1
100 MHz, land path, 50% time



50% of locations
 h_2 : representative clutter height

FIGURE 1a
Field strength (dB(μV/m)) for 1 kW e.r.p.



Frequency: 30-250 MHz (Bands I, II and III); land; 50% of the time;
50% of the locations; $h_2 = 10$ m; $\Delta h = 50$ m

FIGURE 4

100 MHz, sea path, 50% time

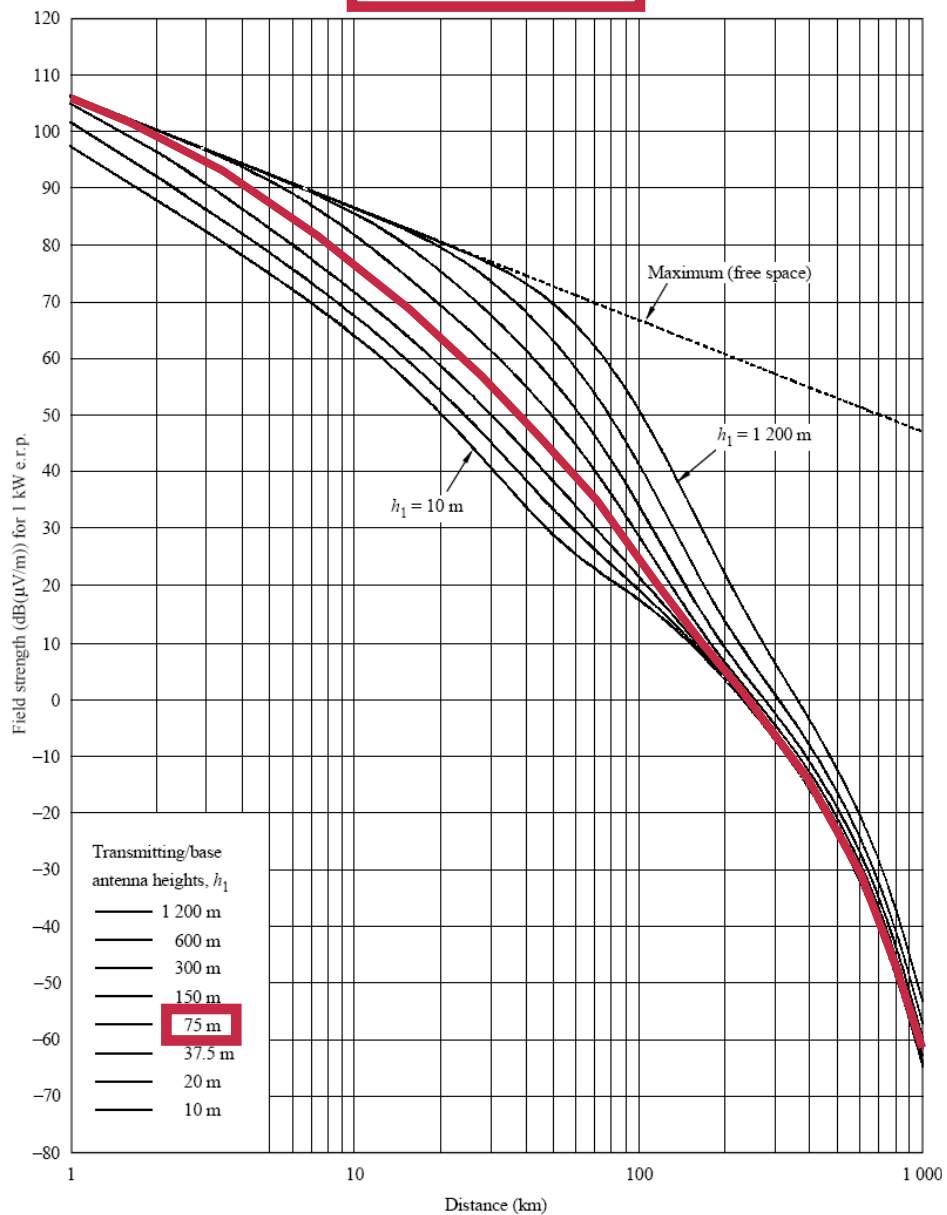
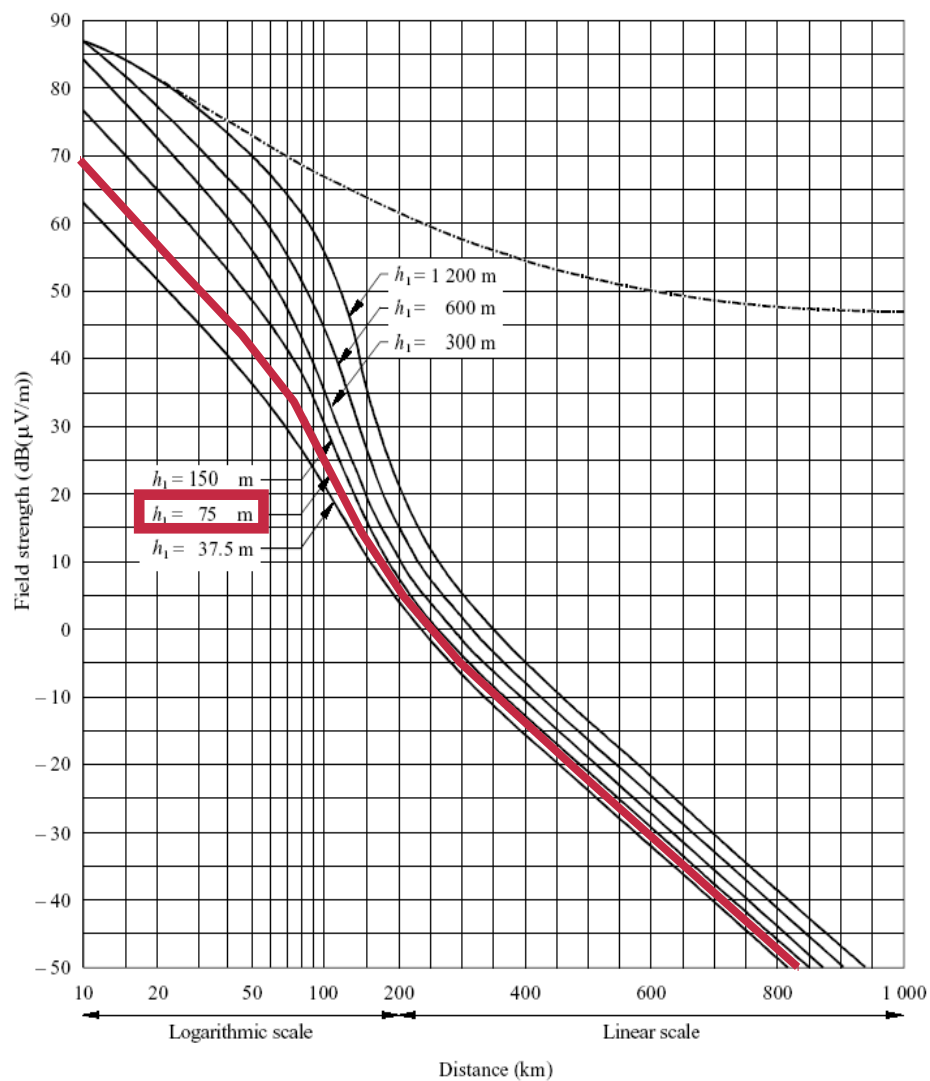


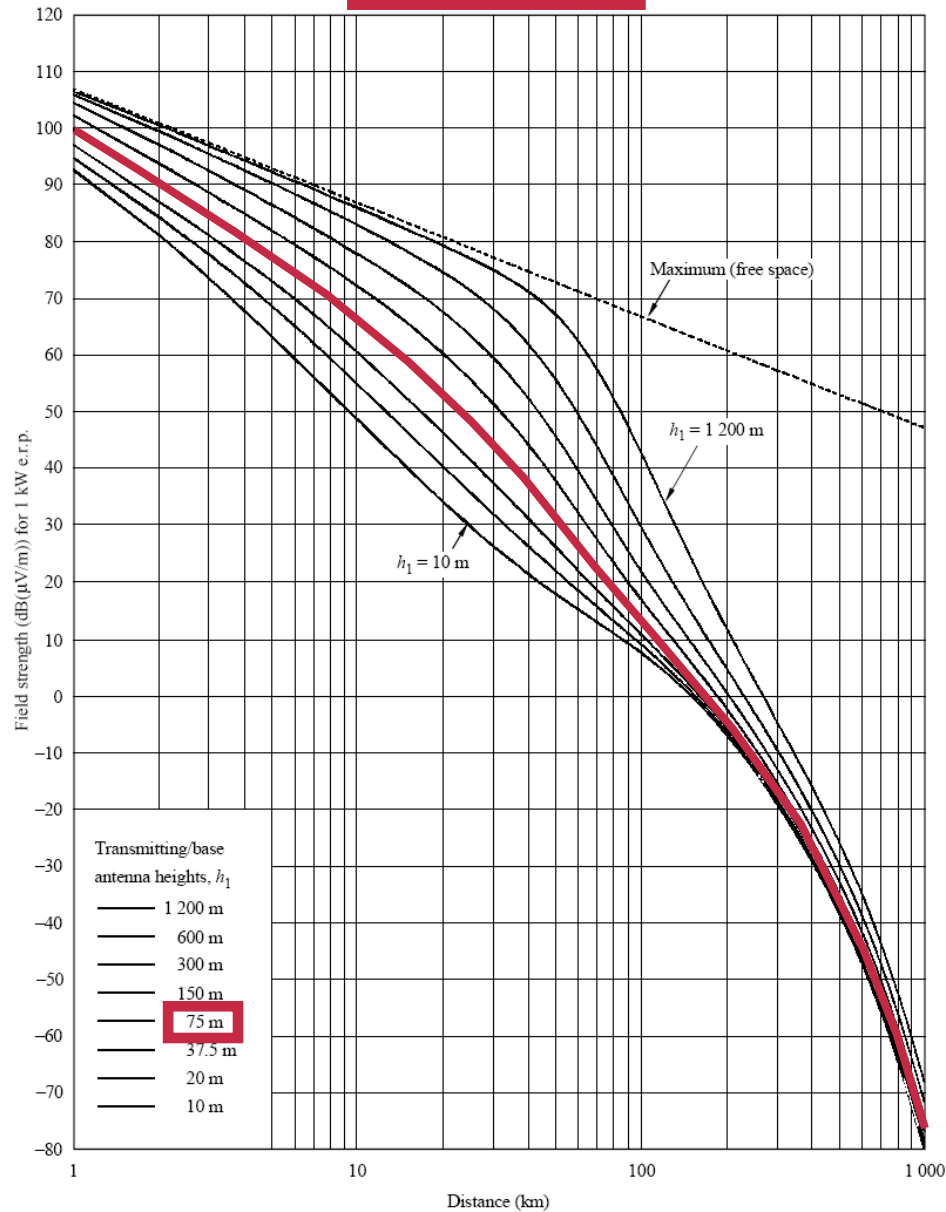
FIGURE 1b

Field strength (dB(μ V/m)) for 1 kW e.r.p.

Frequency: 30-250 MHz (Bands I, II and III); sea; 50% of the time;
50% of the locations; $h_2 = 10\text{ m}$

Field strength (dB(μ V/m)) for 1 kW e.r.p.

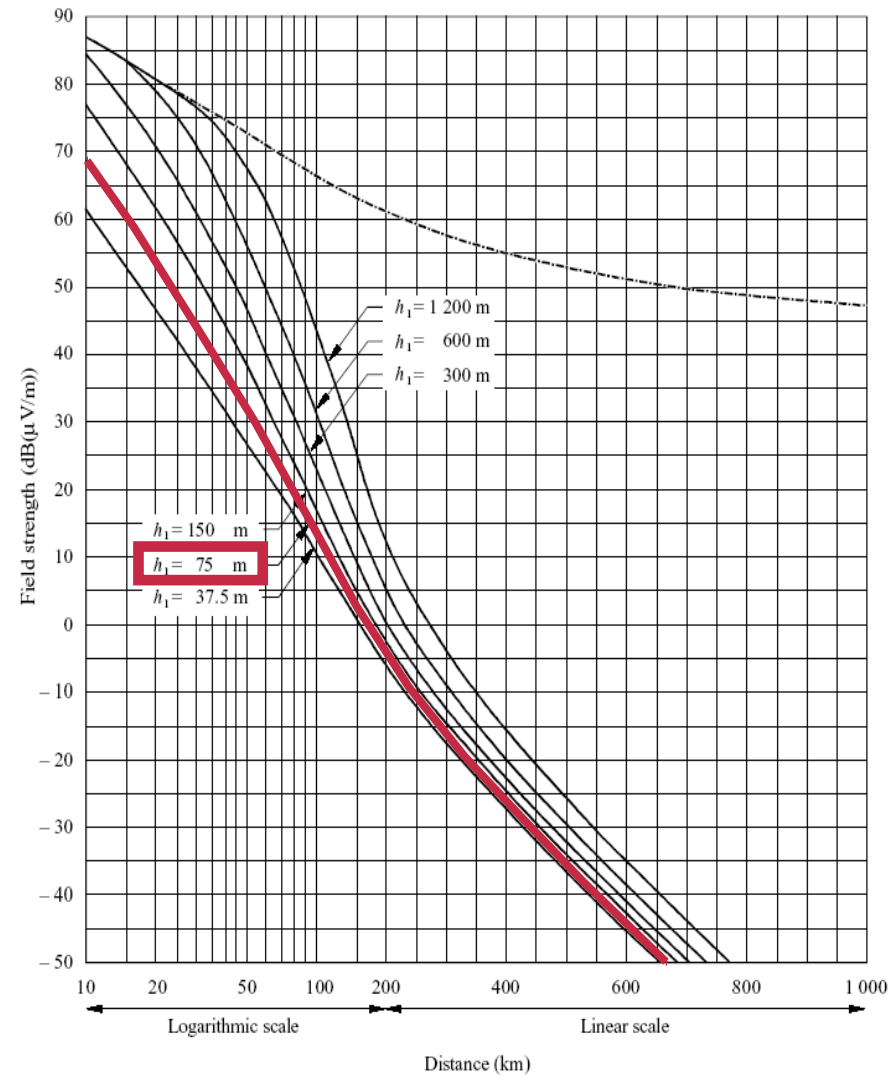
FIGURE 9
600 MHz, land path, 50% time



50% of locations

 h_2 : representative clutter height

1546-09



Frequency: 450-1 000 MHz (Bands IV and V); land; 50% of the time;
50% of the locations; $h_2 = 10$ m; $\Delta h = 50$ m

Free space

D16

FIGURE 12

600 MHz, sea path, 50% time

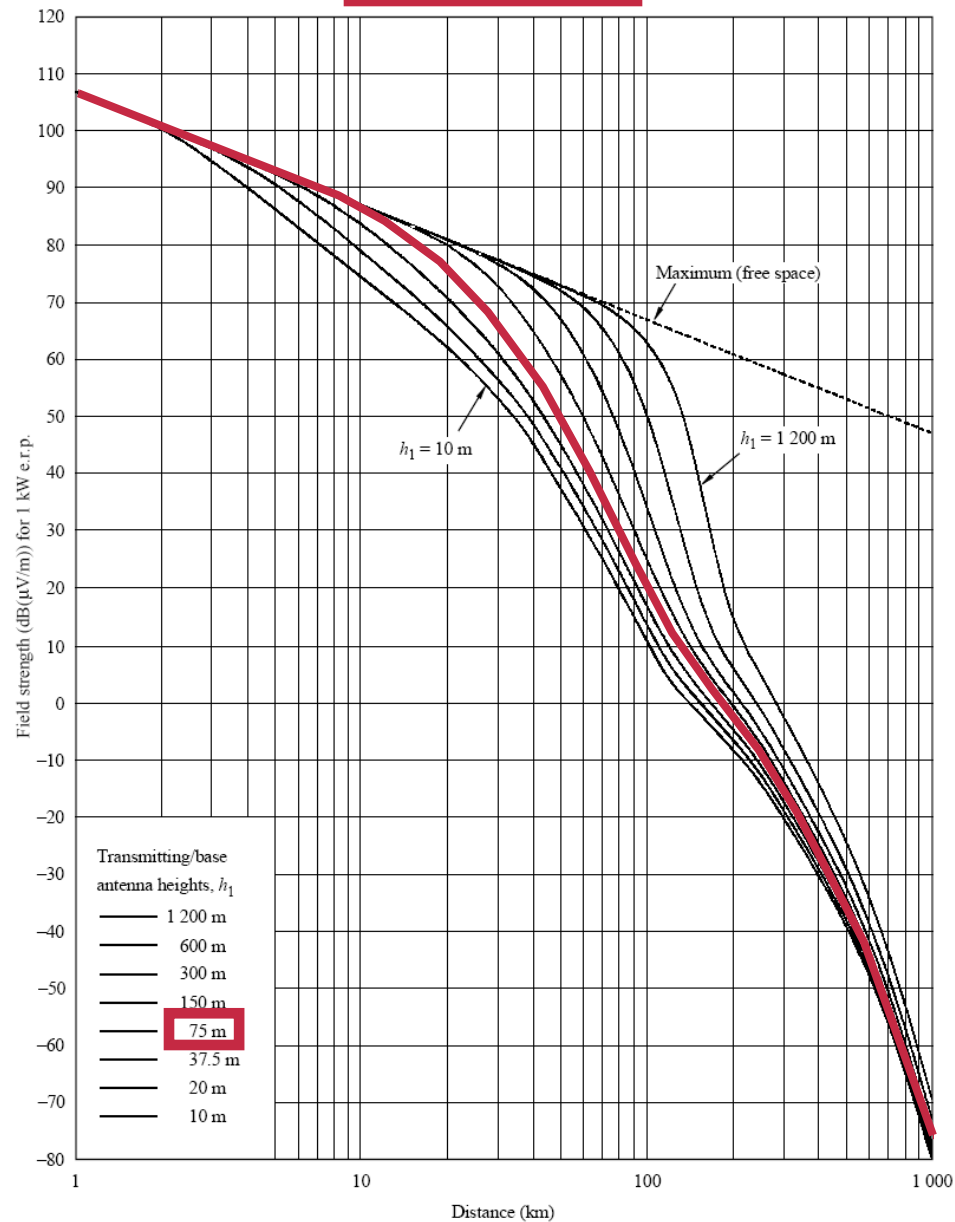
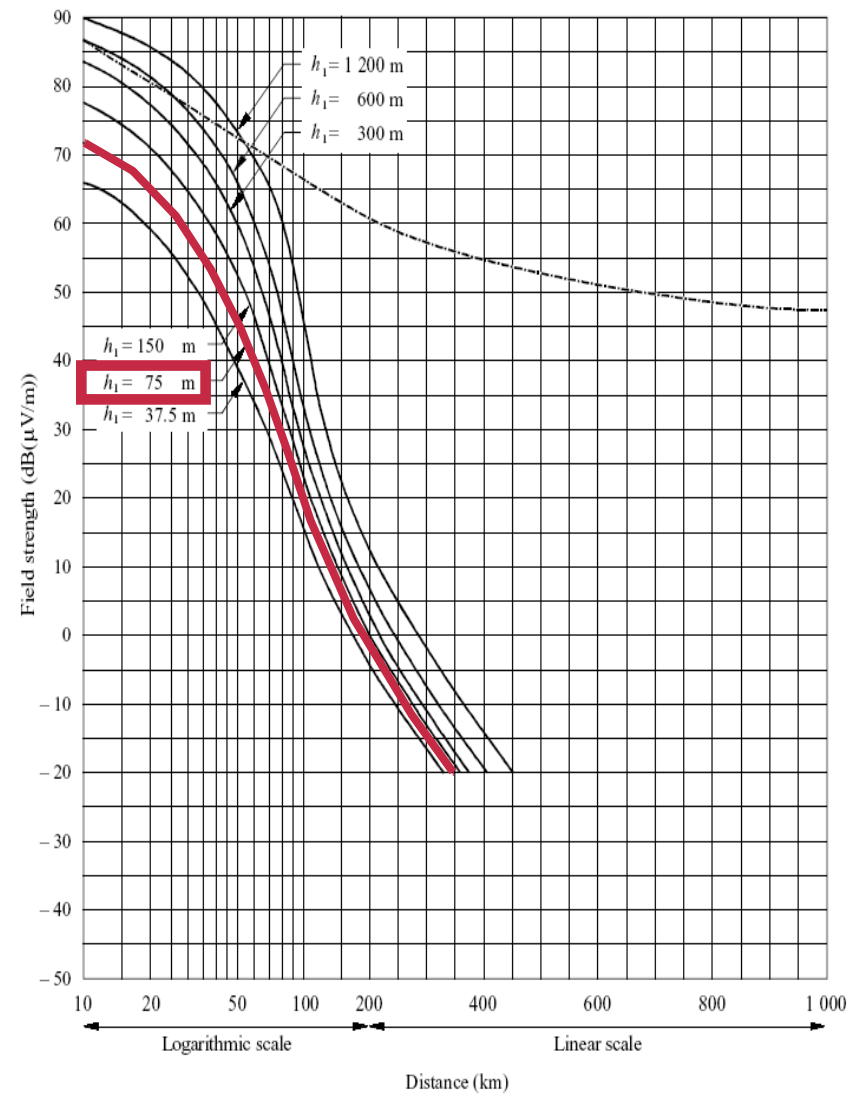


FIGURE 13

Field strength (dB(μ V/m)) for 1 kW e.r.p.



Frequency: 450-1 000 MHz (Bands IV and V); sea; 50% of the time;
50% of the locations; $h_2 = 10$ m

f = 200 MHz

Layers

- ☒ VHF/UHF Stations
 - VHF/UHF
- ☒ VHF/UHF Study Results
 - ☒ rec370_200M_EpsteinL
 - ☒ rec1546_200M_EpsteinL
 - ☐ rec1546_200M_EpsteinL Value
 - High : 2.705848
 - Low : -196.501511
 - ☐ rec370_200M_EpsteinL Value
 - High : -1.359703
 - Low : -197.226028
- ☒ OTHERS
- ☒ TERRAIN DATA
- ☒ WORLD DATA

GENERAL**Location Konya****Path type****Land****Diff.Model****Epstein****KFactor 1.33****Time% 50****Loc% 50****RxAntEnv****Rural****TransType****TRANSMITTER****TxLoc 38 31
09N****32 50****46E****AntHeight****70m****Power 60 dBW****AntGain 0 dBi****RECEIVER****ProtectRat 10
dB****AntHeight 10
m****AntGain 0 dBi****Land path,
%50 time****Rec. ITU-R
P.1546****Rec. ITU-R
P.370**

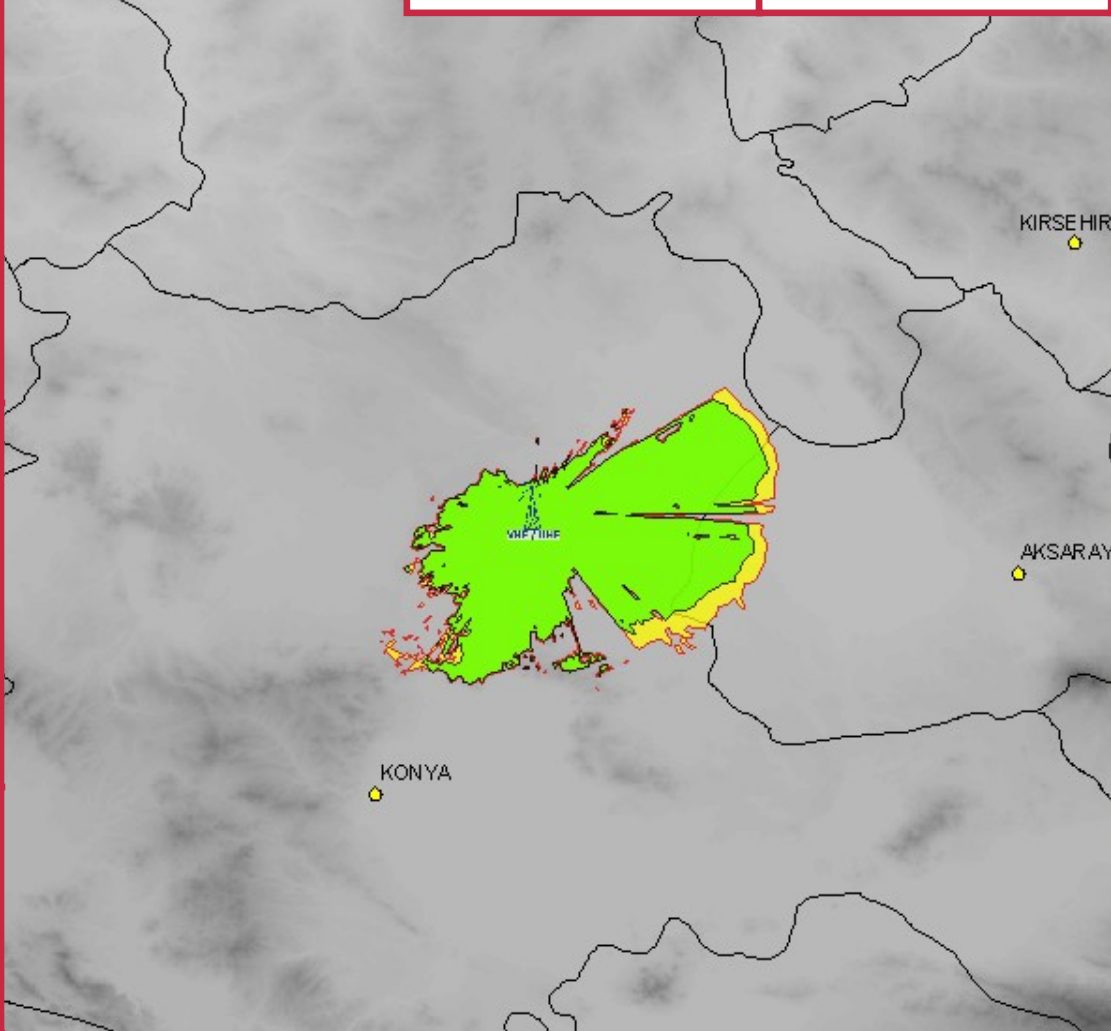
Display Source Selection

Drawing Arial 10 B I U

31°36'55.26"E 38°54'36.96"N

f = 650 MHz

- Layers**
- ☒ VHF/UHF Stations
 - VHF/UHF
 - ☒ VHF/UHF Study Results
 - ☒ rec370_650M_EpsteinL
 - ☒ rec1546_650M_EpsteinL
 - ☐ rec1546_650M_EpsteinL Value
 - High : -7.481897
 - Low : -221.083603
 - ☐ rec370_650M_EpsteinL Value
 - High : -11.597370
 - Low : -200.001007
 - ☒ OTHERS
 - ☒ TERRAIN DATA
 - ☒ WORLD DATA

GENERAL
Location Konya
Path type**Land****Diff.Model****Epstein****KFactor 1.33****Time% 50****Loc% 50****RxAntEnv****Rural****TransType****TransType****TRANSMITTER****TxLoc 38 31****09N****32 50****46E****AntHeight****70m****Power 60 dBW****AntGain 0 dBi****AntGain 0 dBi****RECEIVER****ProtectRat 10****dB****AntHeight 10****m****AntGain 0 dBi****Land path,
%50 time****Rec. ITU-R
P.1546****Rec. ITU-R
P.370**

Display Source Selection

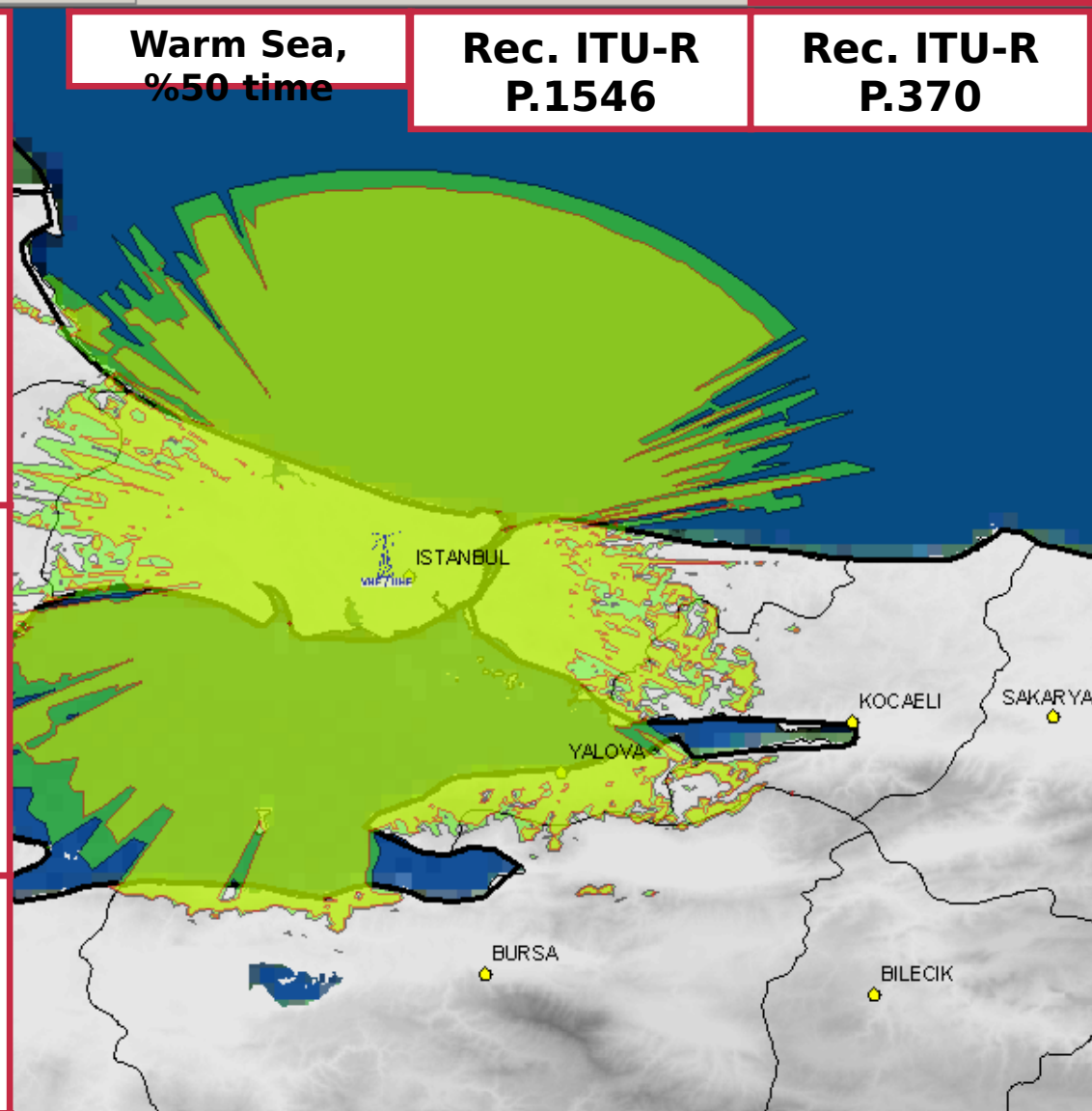
Drawing Arial 10 B I U A

Display the properties of this layer

3520.57 4353.00 Kilometers

f = 200 MHz

- Layers**
- ☒ VHF/UHF Stations
 - VHF/UHF
 - ☒ VHF/UHF Study Results
 - ☒ rec370_200M_Epstein
 - ☒ rec1546_200M_Epstein
 - ☐ rec1546_200M_Epstein Value
 - High : 2.173156
 - Low : -172.08210
 - ☐ rec370_200M_Epstein Value
 - High : -2.116842
 - Low : -177.22370
 - ☒ OTHERS
 - ☒ TERRAIN DATA
 - ☒ WORLD DATA

GENERAL**Location****Istanbul****Path type****WarmSea****Diff.Model****Epstein****KFactor 1.33****Time% 50****Loc% 50****RxAntEnv****WarmSea****TRANSMITTER****TxLoc 41 08****17N****28 49****45E****AntHeight****70m****Power 60 dBW****AntGain 0 dBi****RECEIVER****ProtectRat 10****dB****AntHeight 10****m****AntGain 0 dBi****Pol****Vert****Warm Sea,
%50 time****Rec. ITU-R
P.1546****Rec. ITU-R
P.370**

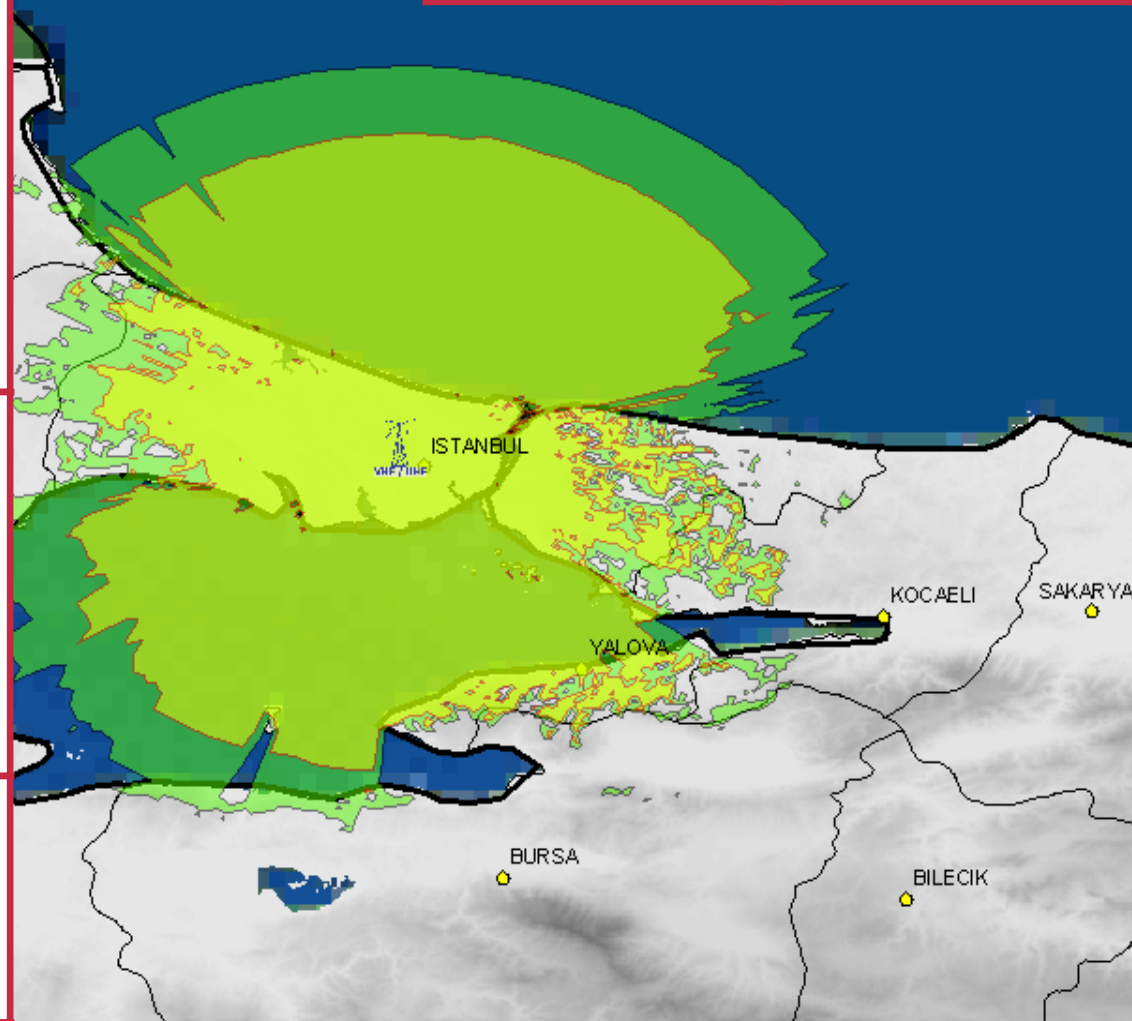
Display Source Selection

Drawing Arial 10 B I U A

27°11'35.23"E 40°54'32.36"N

f = 650 MHz

- Layers**
- ☒ VHF/UHF Stations
 - VHF/UHF
 - ☒ VHF/UHF Study Results
 - ☒ rec370_650M_Epstein
 - ☒ rec1546_650M_Epstein
 - ☐ rec1546_650M_Epstein Value
 - High : -8.064544
 - Low : -173.71350
 - ☐ rec370_650M_Epstein Value
 - High : -12.354510
 - Low : -185.78302
 - ☒ OTHERS
 - ☒ TERRAIN DATA
 - ☒ WORLD DATA

GENERAL**Location****Istanbul****Path type****WarmSea****Diff.Model****Epstein****KFactor 1.33****Time% 50****Loc% 50****RxAntEnv****WarmSea****TRANSMITTER****TxLoc 41 08****17N****28 49****45E****AntHeight****70m****Power 60 dBW****AntGain 0 dBi****RECEIVER****ProtectRat 10****dB****AntHeight 10****m****AntGain 0 dBi****Pol****Vert****Warm Sea,
%50 time****Rec. ITU-R
P.1546****Rec. ITU-R
P.370**

Display Source Selection

Drawing Arial 10 B I U A

COMPARISONS

ITU-R P.1546 vs. ITU-R P. 370

ITU-R P.1546 (compared to ITU-R P.370)

- ❑ **Larger coverage areas,**
- ❑ **Larger interference areas,**
specially at higher frequencies and warm sea
- ➡ **More interference predictions by ITU-R P.1546.**
- ➡ **Requirement for additional studies**



POINT OF CONTACT



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sales_mars@iltaren.tubitak.gov.tr

URL:

<http://www.iltaren.tubitak.gov.tr/mars>

UNCLASSIFIED



QUESTIONS ?



Demonstration on



DBMS DATABASE MANAGEMENT SYSTEM

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CONTENTS



1. Summary

2. System Architecture

3. **SYSTEM version 2.2**

- ✓ **Web Interface - Procedural Interoperability Example**
- ✓ **DBMS - DataBase Management System**

4. **DBMS v3.0**

Demonstration on



SMAS SPECTRUM MANAGEMENT AND ANALYSIS SYSTEM

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CONTENTS



1. Summary
2. System Architecture
3.  **SYSTEM version 2.2**
 - ✓ **SMAS - Spectrum Management Analysis Software**
4.  SMAS v3.0,